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ASTM BULLETIN

Published by
AMERICAN SOCIETY for TESTING MATERIALS

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MAY—1943

No. 122

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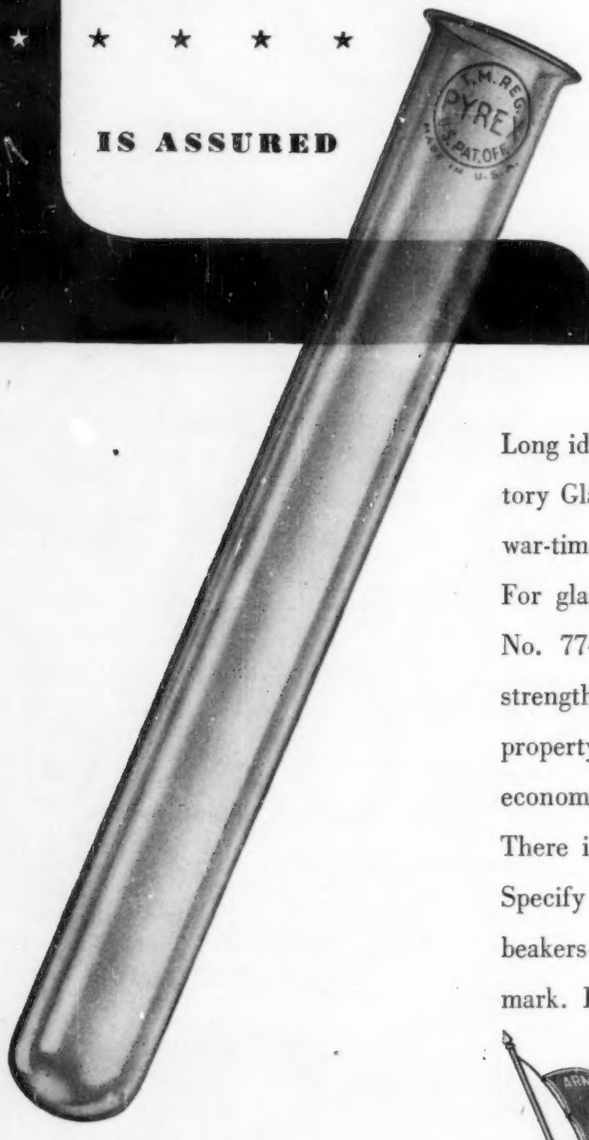

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ASTM BULLETIN

"Promotion of Knowledge of Materials of Engineering and Standardization of Specifications and Methods of Testing"

TELEPHONE—PENnypacker 3545 R. E. Hess, Editor CABLE ADDRESS—TESTING

R. J. Painter, Associate Editor

Number 122 May, 1943

Forty-sixth Annual Meeting, Pittsburgh, June 28 to July 2

15 Technical Sessions with About 100 Papers and Reports; Committee Meetings Schedule Heavier

Groups of Papers and Reports on:

Fatigue
Metals at Elevated Temperatures
Dissolved Oxygen in Feedwater
Identification of Water-Formed Deposit Scales and Corrosion Products
Hardness Testing
Petroleum and Asphalt Products
Non-Ferrous Metals
Electrodeposited Coatings
Coal
Carbon and Alloy Steels
Magnetic Analysis
Plastics
Corrosion Testing
Cement, Lime and Other Building Materials
Concrete and Concrete Aggregates

Two features of the forthcoming A.S.T.M. annual meeting in Pittsburgh, June 28 to July 2—the Society's Forty-sixth Annual Meeting—should be noted immediately, namely, the strong technical program that is being developed with a large number of interesting technical papers and numerous committee reports; second, the unusually large number of technical committee meetings that are anticipated. At the some 15 sessions scheduled for the meeting there will be groups of papers and reports on the subjects listed at the head of this article. In some cases a large number of technical authorities will participate in the sessions—details are given below.

General arrangements for the meeting are in the charge of the A.S.T.M. Pittsburgh District Committee headed by A. R. Ellis, President, Pittsburgh Testing Laboratory, with J. J. Shuman, Inspecting Engineer, Jones & Laughlin Steel Corp., vice-chairman; and H. A. Ambrose, Gulf Research and Development Co., secretary.

Pittsburgh as Annual Meeting City

With Atlantic City out of the question for an annual meeting, because the hotels have been acquisitioned by the Army Air Corps, and with other eastern industrial centers offering problems, the Executive Committee in considering annual meeting cities naturally turned toward Pittsburgh, Detroit, etc., and because of the very cordial invitation from the Pittsburgh District Committee, also the facilities offered by the Hotel William Penn, but primarily because Pittsburgh is very close to the center of gravity of A.S.T.M. membership, the Executive Committee finally decided to hold the 1943 Annual Meeting there.

A.S.T.M. has always had a large and active group of members and committee people from the Pittsburgh area, and while a predominant number of these are concerned with the metals fields, it is surprising to note the diverse industries represented in the Pittsburgh area, their extent, and their interest in A.S.T.M. work. (The accompanying article outlining some Pittsburgh high lights emphasizes this statement.)

Interrelation of Technical Sessions and Committee Meetings

Most of the Society's large standing technical committees take advantage of the annual meeting, with a large number of their members usually present, to hold one or more meetings and it has not been unusual to have some 200 to 250 technical committee meetings throughout the five days of an annual meeting. The problem of arranging 15 to 20 technical sessions so that they will conflict as little as possible with each other and at the same time provide ample time for committee meetings is very difficult.

This year Committee E-6 on Papers and Publications, which is in charge of the technical program, recognized that many of the Society's committees would want to meet in Pittsburgh since some have postponed meetings because of transportation problems and the great pressure under which practically every technical man is today working. Consequently, the 1943 program differs some-

Provisional Program in this Issue

For details of the Provisional Program, 1943 Annual Meeting, and synopses of technical papers and reports, see page 43. This program is intended to provide members, and others concerned, with as complete as possible advance information on the program.

what from previous years in an attempt to provide more time during the week for committee meetings. All day Monday, for example, is reserved for committee meetings, and a large number of the committees can meet on Tuesday and have few conflicts with the technical sessions. Throughout the week many of the committees will find hours where meetings can be conveniently held.

Edgar Marburg Lecture– General Session

Edgar Marburg Lecture:

The Society's Eighteenth Edgar Marburg Lecture will be presented on June 29 at 4:30 with L. J. Markwardt, Chief, Division of Timber Mechanics, U. S. Forest Products Laboratory, Madison, Wis., speaking on "Wood as an Engineering Material." Some information on the lecturer's background and a short synopsis of the subject appear on an adjoining page. This subject will be of widespread interest because of the rapidly extending uses of wood in many forms.

General Session:

The Pittsburgh Committee is planning to have one or more outstanding speakers at the Society's general session on Wednesday evening. Further announcement of this feature will be made. At this time a number of short reports of the Society's administrative committees will be given. The 1943 Dudley Medal will be awarded at this session. The annual address of the President will also be given.

Newly elected officers will be introduced and recognition will be given to members who since last year have joined the distinctive 40-year class.

Technical Symposiums on Identification of Water-Formed Deposits; Soil Testing Methods; Hardness

As previously announced, several outstanding groups of papers and discussions will feature the technical program, notably a Symposium on Identification of Water-Formed Deposits, Scales and Corrosion Products by Physicochemical Methods; a Symposium on Soil Test Methods; and a third dealing with Hardness Testing.

Water Symposium:

An appropriate and proper understanding of the cause and prevention of deposit scales and corrosion products may be secured when such materials are correctly identified. The statement of the results secured by chemical analysis furnishes a general picture of the amounts of each oxide present. The calculation of the items in the analysis to molecular form does not, in all cases, furnish the true nature of complex materials that are formed under operating conditions. The tools of the research investigator, the polarizing microscope, the spectrograph, and the X-ray units are now being applied to the problems that occur in the use of water in industry. These tools are beginning to make available a fund of technical data. This permits the more proper identification of materials. The interpretations of these results allow a correct diagnosis of the undesirable conditions.

The program is to be introduced by presentation of results secured from a round-robin test of two samples of scales. There will be shown in successive steps the data found by macro- and microchemical analysis, by the microscope, by spectrographic and X-ray analysis. The identification of the materials and the interpretations of the analysis will be shown. This will serve to introduce the various papers included in the program. H. C. Miller, Research Chemist, Public Service Gas and Electric Co., will present this introduction and will serve as chairman for the symposium.

The three papers (see third session, Provisional Program) and discussion will furnish valuable information on the mechanism of formation of scales, deposits, and corrosion products throughout the water cycle. Attention is to be focused on conditions resulting from the use of water both in process work as well as in the evaporative industry.

During this third session, R. C. Adams, Chemical Engineer, U.S.N., Engineering Experimental Station, will discuss "Laboratory and Field Methods for the Determination of Dissolved Oxygen." The second paper of this series will be presented by members of the staff of the Detroit Edison Company—"Applicability of the Schwartz Gurney Method for Determining Dissolved Oxygen in Boiler Feed Water, and Modification of the Method to Make It Applicable Especially in the Presence of Reducing Agents."

Committee D-19 is sponsoring this interesting session.

Symposium on Soil Testing Methods:

Technical reports and discussions have been solicited from a large number of authorities on soils and in the two sessions (morning and afternoon, June 29) devoted to this symposium leaders will summarize the material submitted, after which the meeting will be thrown open for discussion from the floor. It is expected various methods of investigating different types of soils will be stressed and in addition there will be much discussion on problems involved in stabilization and treatment of soils with different materials—asphalt, cement, bituminous mixtures, and

War Meeting?

Will the 1943 Annual Meeting in Pittsburgh be a war meeting? The answer is yes . . . and no.

If by a war meeting is meant that our usual type of meeting is being set aside and a meeting along new lines being instituted devoted solely to war discussion, the answer would be no. But obviously in its whole concept, the work of the Society in facilitating industrial contacts between producer and consumer and in general through its very widely used specifications and tests and its extensive and authoritative data on material has been aiding production of materials and consequently is and has been contributing directly to the war effort.

To be sure, many of the activities, particularly in the fields of both ferrous and non-ferrous metals, plastics, and petroleum, to name but a few, have been greatly accelerated in view of war needs. Many government representatives will be present as part of their regular assignments and will work in helping to advance A.S.T.M. committee activities, and any representatives from the nation's capital or Armed Services concerned with materials are cordially welcome to attend the meeting.

The Society officers, partially in recognition of the tremendous pressure under which those in the services are working and partly in recognition of the necessity of confining distribution of data on production or technical points involved in war matériel, feel that the meeting should be concentrated on the technical work.

other products. Committee D-18 on Soils for Engineering Purposes is sponsoring this symposium.

Hardness Test:

This discussion is part of a series which the Society is sponsoring on the general topic—Significance of Mechanical Tests of Materials. The first in the series, a Symposium on the Significance of Tension Tests of Metals in Relation to Design, was held three years ago. The present symposium, which has been developed by Prof. J. M. Lessells, will include some introductory notes and discussion by him; a paper by Prof. S. R. Williams, Amherst College, covering "Present Types of Hardness Tests;" and a paper by J. O. Almen, General Motors Research Laboratories, on the general subject, "Some Limitations of Our Present Hardness Testing Methods." Prepared discussion is being elicited from other authorities on this subject.

Other Technical Sessions

The fifth session, on Wednesday morning, relates to petroleum products, asphalts, and such materials, with five reports and four papers on such topics as absolute viscosity; performance of slow curing asphalts; accelerated weathering of bituminous materials; and testing and evaluating road tars.

The first of several interesting sessions dealing with ferrous and non-ferrous metals is also to be held on Wednesday morning, June 30, covering corrosion and electroplated coatings. In addition to the reports of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys and A-5 on Corrosion of Iron and Steel, which are always of particular interest because of the extensive research tests under way in these groups, there are two papers—one dealing with atmospheric corrosion of copper, the other with total immersion corrosion tests. This session is notable for four papers on electrodeposited coatings—one dealing with thickness and finishing of chromium plate; another with properties of plated lead coatings on steel; discussion by Dr. Baker, chairman of Committee B-8 on Electrodeposited Coatings, on factors underlying specifications for electrodeposited metallic coatings; and the fourth paper dealing with the salt-spray test.

On Wednesday afternoon, the seventh and eight sessions are simultaneous, the former dealing with a miscellaneous group of materials—textiles, soaps, fire tests, glass, thermal insulating materials, coal and coke, with papers on a laboratory method for evaluating synthetic detergents; fire resistance and thermal properties of concrete slabs; and a test for measuring plastic characteristics of coking coals.

The eighth session devoted entirely to non-ferrous metals has six reports (all the "B" committees except two—these two, B-3 and B-8, are in the sixth session) and there are five papers dealing with lead alloy-coated copper wire; performance of anodic coatings on aluminum alloys; plastic bending for aluminum alloy 17S-T; conservation of tin and soft solders; and short-time tests of low-tin solders listed in recent Federal specifications.

Thursday Sessions

The five sessions scheduled for Thursday are of widespread interest to large groups of members and others concerned with materials. Seven reports are listed for the eleventh session, on iron and steel, Thursday morning, July 1, with four technical papers—a rather heavy session, but several of the reports will probably be in the nature of reviews of progress. Three of the papers concern the following: measuring drawability of deep-drawing steels; strain aging of killed low-carbon steel; and structure and creep of cast carbon-molybdenum steel at 950 F. The fourth paper deals with measurement of permeability, which ties in with the report of Committee A-6 on Magnetic Properties.

The other session on Thursday morning will be notable for the large number of proposed new specifications that will be offered, including several in the fields of paint, varnish, lacquer, and related products, paper and paper products, electrical insulating materials, rubber and rubber products, and plastics. To those concerned with rubber, a paper dealing with application of flow data in design problems will be of concern. Likewise, those in the plastics field, both as producers and consumers, will find of specific interest three papers, one on scratch hardness, a second on impact testing, and a third on relation between repeated blow impact tests and fatigue tests.

Effect of Temperature—Fatigue:

The session dealing with effect of temperature and fatigue is featured by seven papers, four dealing with temperature effects, one on interpretation of creep-test data, and another covering a new chart for estimating working stresses of alloys at elevated temperatures. The three remaining papers comprise discussions on fatigue, including the effect of overstressing and understressing; fatigue properties of some cold-drawn nickel-steel wire; and fatigue tests on some copper alloys in wire form.

Cementitious Materials; Concrete:

In addition to six papers covering various problems involving lime, mortar, and cement, there are several short technical discussions appended to the report of Committee C-1 on Cement which will be outlined in this fourteenth session on Thursday afternoon, July 1. Outstanding authorities in this field are participating, presenting papers on measurement of bond between bricks and mortar; increasing the reflectivity of standard portland-cement concretes by addition of hydrated lime, effect of alkalies in portland cement on the durability of concrete, and studies to develop an accelerated test procedure for the detection of adversely reactive cement-aggregate combinations are included.

In addition to the report of Committee C-9 on Concrete and Concrete Aggregates and several technical contributions the last session on Thursday evening will include the report of Committee C-8 on Refractories. (See another page of this Bulletin for discussion of important recent actions of the Society involving new specifications and tests for refractories.) There will be much of interest in

Important Standards Activities

Important new specifications and revisions have been approved. For details see article on page 11 in this Bulletin. A complete list of Emergency Standards and Emergency Alternate Provisions appears on the last text pages.

each of the technical papers, including the ones describing a simplified test for evaluation of mixing effectiveness of concrete mixers; effect of membrane curing upon the durability and strength of concrete; and a new aspect of creep in concrete and its application to design. The final paper deals with investigations of the resistance of concrete to freezing and thawing, as affected by the coarse aggregate.

Many Proposed Standards

An advance tabulation of new tentative specifications and tests which may be proposed at the meeting indicates that upward of 60 of these will be forthcoming. Of course, committees may not ask for formal action during the annual meeting, but instead may propose that draft standards be published as information and for comment. Including several of these projected draft standards there will undoubtedly be a number of new standards in the field of paint, varnish, lacquer, and related products; petroleum products and lubricants; coal and coke; paper and paper products; electrical insulating materials; rubber products; textile materials; plastics; and copper and copper alloys, cast and wrought. A number of these proposals are listed in the synopses of committee reports—see Provisional Program in this issue.

Preprints Sent on Request

In a separate mailing there is being sent to each A.S.T.M. member a Preprint Request Blank by which he can request a copy of any of the technical papers and reports preprinted in advance of the meeting. This blank should be returned promptly and should be carefully marked. The Provisional Program will enable members to make a selection of the items desired. Preprints will be forwarded to those members in good standing in two or three installments. *Members should note that preprints will not be sent unless requested.*

Transportation Reservations Should Be Made Early

Undoubtedly many of the members and committee members have had sufficient experience with the heavy traffic now prevalent so that a warning to make transportation reservations sufficiently early is unnecessary. Nevertheless, it is urged that each person planning to attend the annual meeting make arrangements for transportation well in advance. There are no special rates in effect.

Hotel Reservations, Advance Registration

It is desirable that all members should make their hotel reservations promptly and for this purpose a return card addressed to the management, Hotel William Penn, is being sent in a separate mailing.

In order to expedite registration of members at the meetings, it is desirable to have as many registration details as possible taken care of in advance and it would be very helpful if members would fill out and mail promptly to A.S.T.M. Headquarters the advance registration card that is being sent.

A.S.T.M. Registration Desk.—The A.S.T.M. Registration Headquarters will be on the Seventeenth Floor of the Hotel William Penn. This floor also has the rooms which will be used for technical sessions and for most of the committee meetings. There will be plenty of lounging space and opportunity for private conferences near the registration desk. A display of A.S.T.M. publications and information about the Society is planned.

No Golf Tournament or Entertainment

Because of the war emergency, no special entertainment features have been planned by the Pittsburgh Committee, but information about interesting points in the city, industrial plants, and related items will be available at the A.S.T.M. registration desk.

The annual golf tournament, which has featured recent meetings, will likewise be canceled this year.

1943 Edgar Marburg Lecture

L. J. Markwardt Will Cover Wood as An Engineering Material

One of the very notable sessions to feature the 1943 (46th) Annual Meeting of the Society in Pittsburgh will be held on Wednesday afternoon, June 30, with L. J. Markwardt, Chief, Division of Timber Mechanics, U. S. Forest Products Laboratory, Madison, Wis., delivering the Eighteenth Edgar Marburg Lecture, on the subject, "Wood as an Engineering Material." Those who had the privilege of hearing Mr. Markwardt's informal talks and demonstrations on timber at the Philadelphia District Committee meeting last fall and at the spring meeting of the Chicago District will know full well the treat in store for those at this session. An outstanding authority in this field with years of intensive effort in development and research work, Mr. Markwardt will also bring to the lecture platform a most pleasing style of delivery.

Wood is being used in treated or modified form in many applications undreamed of but a few years ago, with properties so altered that one can hardly recognize the basic material as wood or timber. In presenting the latest data on application, properties, etc., Mr Markwardt will also outline some of the notable progress made by the timber industry in making maximum use through new processes, and in expediting older processes from cutting to finished product. Some important points to be touched

on in the lecture are outlined in the statement appearing below.

In selecting Mr. Markwardt for the 1943 Edgar Marburg Lecture, the committee in charge, headed by Past-President G. E. F. Lundell, has continued the policy of having covered at annual meetings of the Society by leaders in their respective fields outstanding developments in the knowledge of materials. The lecture was established in 1926 to stress the Society's function in promoting knowledge of materials and also to commemorate the name of Edgar Marburg, the Society's first secretary who placed A.S.T.M. on a firm foundation and brought wide recognition to the Society as an outstanding forum for discussion of properties and tests of materials. Beginning with the first lecturer, Dr. A. N. Talbot, each year the annual meeting has been featured by the appearance of some authority in his field—G. L. Clark on X-ray, F. B. Jewett on Transoceanic Telephony, C. E. Kenneth Mees on Color, H. J. Gough on Crystalline Structure in Failure of Metals, L. B. Tuckerman on Aircraft Materials, A. L. Day on Glass, and others including H. H. Moore, P. H. Bates, H. L. Fisher, and Graham Edgar.

Mr. Markwardt, a native of Lansing, Iowa, is a graduate of the University of Wisconsin in Civil Engineering, receiving a B.S. Degree in 1912 and the C.E. Degree in 1922. He served three years on the faculty of the Engineering College of the University of Wisconsin. He has been in engineering research work at the U. S. Forest Products Laboratory at Madison for nearly 30 years. At the Laboratory he is in charge of the Division of Timber Mechanics, which now is carrying on very extensive research on war problems. Mr. Markwardt is the author of numerous bulletins, papers, and articles dealing with the properties and engineering uses of wood—four of his technical bulletins for the Department of Agriculture have involved strength and related properties of wood grown in the United States and Alaska, with one devoted entirely to redwood.

He has been a member of A.S.T.M. since 1920 and has been particularly active in the work of Committee D-7 on Timber, has recently become its secretary and is chairman of the Subcommittee on Methods of Testing Timber. He is a member of the Society of American Foresters, and the Engineering Society of Wisconsin. Also, he is a member of the Timber Research Committee of the International Union of Forest Research Organizations and attended international conferences in this field at London in 1937 and 1939.

As previously indicated, Mr. Markwardt was a guest speaker at meetings sponsored by the Philadelphia and Chicago District Committees, with a large attendance at each of these meetings. Mr. Markwardt's procedure in each of these talks was to demonstrate a wide range of wood and timber products and specimens.

The Marburg Lecture, of course, will constitute a more formal and considerably more extensive presentation. The subject is one of great interest and concern to every materials and testing engineer even though he may not be concerned from the business standpoint with wood.

SYNOPSIS

Wood as an Engineering Material

Along with the sensational developments and progress in various engineering materials since the turn of the century, has come a renaissance of wood that enables it to maintain an important place in the modern world. Mr. Markwardt will present a summary of the more significant research accomplishments with wood as an engineering material, with respect to utilization both in its natural form, and in various modified forms through use of glues and synthetic resins. Included will be an analysis of the relation of the structure to the properties, which is basic to the intelligent use of wood; and a review of advancements in seasoning technique which permit large savings in drying time, and significantly also, marked reduction in drying defects and losses. While glues have always been an important medium to enhance the use of wood, the development of the synthetic resins has opened entirely new horizons in engineering applications. Among other things, they have made possible the manufacture of waterproof plywood, permitting indefinite exposure to the weather or to water. The use of glues has led also to the extensive practical application of laminated construction in which large members can be satisfactorily fabricated from small pieces. The introduction of modern metal connectors has strengthened the "Achilles heel" of wood frame construction, the joints and fastenings which are almost invariably the weakest link.

A variety of paper, fiber, and modified wood materials with remarkable properties is also in the making, or are already commercial products, including the so-called "compreg" and "papreg," representing densified materials incorporating synthetic resins.

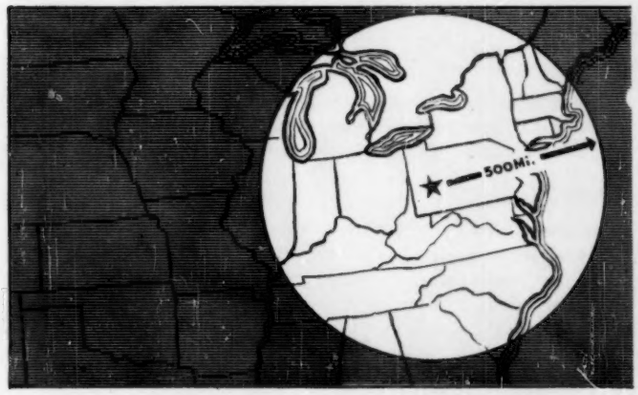
Research has brought not only the development of new adaptations but also refinements in engineering formulas and design data. Improvements in structural grading of timber have made more precise strength evaluation possible and have led to the preparation of A.S.T.M. standards for structural grades.

Accelerated research during the war is bringing a wealth of new data on engineering design, particularly in the field of plywood. It is anticipated that increased attention will be given in future A.S.T.M. committee work to additional standards for methods of testing, and to specifications for glues and other essentials that will play a part in the future engineering use of wood.

ABOUT PITTSBURGH

As INDICATED above, one of the essential reasons for selecting Pittsburgh as the A.S.T.M. Annual Meeting city is its location near the center of gravity of A.S.T.M. membership and the fact that in the area within a radius of 500 miles is a very large percentage of U. S. population, manufacturing establishments, etc. In connection with the accompanying illustration the following figures have been reported:

73 per cent of U. S. Population
83 per cent of the Wages
81 per cent of the Wage Earners
71 per cent of the Manufacturing Establishments
79 per cent of the Value of Manufactured Products



The Mellon Institute.—One of the world's leading scientific centers. The building, 300 feet square, has 62 one-piece columns—among the world's largest. A number of active A.S.T.M. members are located here.

Five Class I railroads serve Pittsburgh including the Pennsylvania and Baltimore and Ohio.

The mean altitude is about 840 ft. above sea level; the Pittsburgh area is about 54½ square miles, with a population of 672,000, and in a 100-mile trading area close to 6,000,000.

The information from the Pittsburgh Convention Bureau indicates the mean temperature for 68 years, excluding the 1935–1936 winter, averaged only two days a year as low as zero, and only 15 days a year as high as 90 degrees. (NOTE FROM EDITOR: Here's hoping!)

In connection with its commercial facilities, the three navigable rivers, Allegheny, Monongahela, and Ohio, carried a combined tonnage in 1940 of 168½ million tons, many times greater than that going through the Panama Canal.

Points of Interest in Pittsburgh:

Some of the points of interest include the Block House, which is all that remains of the original Fort Pitt, built in 1764; the Phipps Conservatory, one of the largest buildings under glass in the world, with a constantly changing panorama of floral exhibits, tropical gardens, and outstanding orchid collection; Stephen Collins Foster Memorial, which adjoins the Cathedral of Learning and is the costliest tribute ever erected to a musician; the Irvin Works, Carnegie-Illinois Steel Corp., the largest and newest unit in Pittsburgh's great chain of steel producing plants; Westinghouse Bridge, located just east of Pittsburgh, the longest concrete span in the world; Allegheny Observatory, where Dr. John A. Brashear and Professor Samuel Pierpont Langley made astronomical discoveries of importance; United States Bureau of Mines, one of the best-equipped experimental stations in the country, carrying on extensive experiments in safety in coal mines.

Educational Institutions:

Pittsburgh is the location of six important colleges and universities including the University of Pittsburgh, Carnegie Institute of Technology, Duquesne University, and Pennsylvania College for Women.

Industry:

The material resource which has made Pittsburgh such an important industrial center is, of course, the extensive layer of bituminous coal which within a radius of 100 miles of Pittsburgh underlies more than 24,000 square miles. This wealth of coal aided the development of the iron and steel industry, assisted by the transportation facilities. This area has large resources of natural gas, petroleum, clay, and limestone.

A list of some of the industrial establishments in Pittsburgh includes the world's largest manufacturers of many products, with some of the world's greatest plants and facilities. Outstanding companies centered in Pittsburgh function in the following fields:

Carbon and Alloy Steel	Food Products
Stainless Steel	Plumbing Fixtures
By-Product Coke	Electrical Equipment
Aluminum	Wire Manufacturing
Tinplating	Radium and Vanadium
Air Brakes	Lifting Jacks
Steel Rolls	Rolling Mill Machinery
Plate Glass	Bolts, Nuts and Rivets
Window Glass	Wrought Iron Pipe
Refractories	Bituminous Coal

Safety Equipment

Bureau of Mines—First-Aid Film; Report on Preventing Butadiene Explosions

A NEW SOUND FILM presenting basic first-aid information in graphic form has just been released by the U. S. Bureau of Mines. It is in 16-mm. sound and runs 31 minutes. Copies are now available for exhibition by industrial and civil defense training classes, civic and business organizations, and other similar groups.

"Help Wanted" portrays typical mishaps causing bleeding wounds, shock, burns, asphyxiation, fractures, and other injuries and methods of treating them.

Application for free loan of "Help Wanted" should be addressed to the Graphic Services Section, Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa., and should state specifically that the borrower has a sound projector.

Continuing its activities to safeguard life and property in mining and allied industries, the Bureau of Mines has recently published a report on experiments to aid the newly established synthetic rubber industry in preventing explosions of butadiene and air mixtures. The report contains tables and graphs which show how much nitrogen and carbon dioxide must be added to make varying mixtures of butadiene and air nonexplosive.

Summarizing the results, the authors state that if nitrogen is used to dilute the mixture, at least 19.6 volumes must be added to each volume of butadiene to render all mixtures noninflammable with air. Only 12.1 volumes of carbon dioxide are required under similar conditions.

A copy of the Report of Investigations 3691, "The Prevention of Butadiene-Air Explosions by the Addition of Nitrogen and Carbon Dioxide," by G. W. Jones and R. E. Kennedy, can be obtained free of charge from the U. S. Bureau of Mines, Department of the Interior, Washington, D. C.

British Schedule of Non-Ferrous Metals and Alloys

RECENTLY RECEIVED at A.S.T.M. Headquarters is a copy of the Services Schedule of Non-Ferrous Metals & Alloys, B.S./S.T.A.7 for armaments and general engineering purposes, copy of which can be obtained from the British Standards Institution, 28 Victoria St., London, S.W.I., at five shillings 6 pence, postage prepaid. This schedule was issued for the Superintendent Technical Applications Metals, Department of the Controller-General of Research and Development, Ministry of Supply, by the Standards Institution. The Foreword is signed by H. J. Gough, Director of Scientific Research, Ministry of Supply. (Many A.S.T.M. members will remember Dr. Gough as the 1933 A.S.T.M. Edgar Marburg Lecturer.) This particular publication covers primarily the copper alloys, and information on this group will serve as a basis for addition of data on other materials. Considerable simplification has been effected. There is general information on conditions of supply, detailed tables of tolerances and tables of relevant specifications, uses, and general notes, in which references are made to a number of British and American specifications including quite a number of A.S.T.M. references.

More New Standards Approved; Both "Regular" and Emergency Actions Involved

Steel Pipe, Refractory Materials, Rubber, Plastics, Die Castings

MANY IMPORTANT actions involving regular and emergency standardization work have been approved by the Society's Committee E-10 on Standards on the recommendation of the various A.S.T.M. standing technical committees responsible for the standardization and research work in the respective fields involved. Since March 20, 14 new specifications have been approved of which 3 are emergency, and 11 regular specifications. During this period also, 5 emergency alternate provisions have been approved in the interest of expediting procurement or conserving critical or strategic materials.

Hardly a week goes by when there is not some recommendation to the Society from one of its technical committees and the Standards Committee, E-10, headed by J. R. Townsend, chairman, with R. D. Bonney, F. H. Jackson, N. L. Mochel, F. E. Richart, and H. S. Vassar, serving, has had its work cut out for it in judging whether a substantial consensus has been reached in the respective technical committees.

An effort is made here to outline some of the more salient features of the various recommendations. The latest complete list of emergency specifications and emergency alternate provisions always appears on the last text pages of each BULLETIN.

The information which follows is arranged according to the serial designations of standing committees, standardization work in the "A" (ferrous), "B" (non-ferrous), "C" and "D" (miscellaneous) groups being covered in that order.

Committee A-1 on Steel (Pipe, Castings, Bolting):

The emergency alternate provisions effective April 8 in the Standard Specifications for Electric-Fusion-Welded Steel Pipe (Sizes 8 in. to but not Including 30 in.) (A 139 – 42) were set up to permit pipe in sizes down to 4 in. in diameter to be purchased according to these specifications and also to bring the requirements on elongation values in line with changes that have been made as a regular feature in the widely used Specifications for Welded and Seamless Steel Pipe (A 53 – 42) and for Lap-Welded and Seamless Steel Pipe for High-Temperature Service (A 106 – 42 T). These values are set up according to the wall thickness of the material—a detailed report appears in the 1942 A.S.T.M. *Proceedings*, page 95. The elongation in 2-in. ranges from a minimum of 35 per cent for material $^{5}/_{16}$ in. and over in wall thickness down to 21 per cent for pipe with walls $^{1}/_{16}$ in. in thickness.

The new Specifications for Heat-Treated Carbon-Steel Bolting Material (A261 – 43 T) apply to material 2 in. and under in diameter for pressure vessels, valves, flanges, and fittings, and cover material such as bars, headed bolts, screws, studs, and bolt studs. These specifications were drafted after intensive work by the Section on Bolting (Subcommittee XXII) to aid in making available standardized materials of relatively high strength with a definite high ratio of yield point to tensile strength which would help many consumers of alloy steels who could not procure sufficient quantities during this emergency period. With maximum carbon on check analysis of 0.57, manganese, 1.06, minimum silicon of 0.13, the physical values

NEW REGULAR AND EMERGENCY SPECIFICATIONS AND EMERGENCY ALTERNATE PROVISIONS ISSUED SINCE MARCH 20

(For complete list of all Emergency items see last text pages of this BULLETIN.)

NEW SPECIFICATIONS AND TESTS

Tentative Specifications for:

Heat-Treated Carbon-Steel Bolting Material (A 261 – 43 T).
Air-Setting Refractory Mortars (Wet Type) for Boiler Furnace and Incinerator Service (C 178 – 43 T).
Cellulose Acetate Molding Compounds (D 706 – 43 T).
Cellulose Acetate Butyrate Molding Compounds (D 707 – 43 T).
Rigid Sheets Made from Vinyl Chloride-Acetate Resins (D 708 – 43 T).
Laminated Thermosetting Materials (D 709 – 43 T).

Tentative Methods of:

Test for Sieve Analysis and Water Content of Refractory Materials (C 92 – 43 T).
Test for Combined Drying and Firing Shrinkage of Fireclay Plastic Refractories (C 179 – 43 T).
Panel Test for Resistance to Thermal and Structural Spalling of Fireclay Plastic Refractories (C 180 – 43 T).
Workability Index of Fireclay Plastic Refractories (C 181 – 43 T).
Test for Thermal Conductivity of Insulating Refractories (C 182 – 43 T).

REVISION OF TENTATIVE SPECIFICATIONS

Tentative Specifications for A.S.T.M. Thermometers (E 1 – 43 T).

EMERGENCY SPECIFICATIONS

Emergency Specifications for:

Special Quality Aluminum-Base Alloy Die Castings (ES – 29).
Chloroprene Sheath Compound for Electrical Insulated Cords and Cables (ES – 28).
Chloroprene Sheath Compound for Electrical Insulated Cords and Cables Where Extreme Abrasion Resistance Is Not Required (ES – 30).

EMERGENCY ALTERNATE PROVISIONS

Emergency Alternate Provisions in:

Standard Specifications for Electric-Fusion-Welded Steel Pipe (Sizes 8 in. to but not Including 30 in.) (A 139 – 42) (EA – A 139a).
Standard Specifications for Alloy-Steel Castings for Structural Purposes (A 148 – 42) (EA – A 148a).
Standard Specifications for Carbon-Steel Forgings for Locomotives and Cars (A 236 – 42) (EA – A 236a).
Standard Specifications for Aluminum-Base Alloy Die Castings (B 85 – 42) (EA – B 85a).
Tentative Specifications for Rubber Sheath Compound for Electrical Insulated Cords and Cables (D 532 – 39 T) (EA – D 532a).

are set up as follows: tensile strength, 100,000 psi.; yield point, 75,000 psi.; elongation in 2 in. min. per cent, 16; reduction of area, 45 per cent min. Essentially the specifications are patterned after the widely used one covering Alloy-Steel Bolting Materials for High-Temperature Service from 750 to 1100 F., Metal Temperatures (A 193 – 40 T).

The emergency alternate provisions in the Specifications for Alloy-Steel Castings for Structural Purposes (A 148 – 42) are designed to focus production on six grades which a comprehensive survey of the industry indicates can be produced in large quantities. The two existing grades, 1 and 2, of Class A, are retained for the emergency and four other emergency grades have been established with, in some cases, reduced physical properties that will help production. Tensile values range from about 75,000 to 150,000 psi tensile strength; yield points of 40,000 to 125,000 psi.; elongation from 24 per cent for the soft material down to 10 per cent for the very high-strength material.

In order to provide prompt relief for a number of railroads which require high-strength forged axles in connection with locomotive and tenders, Subcommittee VI on Steel Forgings on recommendation of a Technical Advisory Committee functioning in the NESS program has approved an extension of emergency Class H (EA – A 236) to include such axles in addition to the other types of locomotive forgings, pins, etc., already covered in this emergency under EA – A 236. This extension in the scope when listed in Schedule 5 of the WPB L-211 limiting order will thus enable railroads which require this material (65,000 psi., min. yield point for solid diameter over 7 to 10 in., with minimum elongation in 2 in. of 18 per cent) to procure it without obtaining exception from the WPB Iron and Steel Branch. Various forging manufacturers are producing axles with properties meeting the minimum requirements.

Committee B-6 on Die-Cast Metals and Alloys:

Procurement problems in connection with high-purity grades of aluminum, zinc, magnesium, etc., required to produce die castings have forced Committee B-6 on Die-Cast Metals and Alloys constantly to review its specifications and a number of emergency alternate provisions have been established in the aluminum and zinc-base specifications. In order to bring certain of the requirements in the Aluminum-Base Die Castings Specifications (B 85) in line with the emergency situation present Alloys VII-A and VII-B with copper 3.5 to 4.5 per cent, silicon 4.5 to 7.5, and 0.3 max. nickel, but with differing requirements on maximum iron and zinc, can be modified in the emergency provisions with a copper range of 3 to 4 per cent; silicon, 4.5 to 9.5 per cent; nickel, raised to 0 5 per cent maximum; and Alloy LXXIX-A has permissible iron of 2.0 per cent and zinc of 1.0, while Alloy LXXIX-B has the same copper and silicon and nickel as LXXIX-A, but retains the iron and zinc same as in the standard Alloy VII-B. Alloy LXXIX-A is designed for a gooseneck machine, while LXXIX-B is for the cold chamber machine.

Special Quality Die Castings (ES-29):

In order that very high-grade aluminum die castings might be made available, emergency specifications have been established to cover special quality material, for applications where breakdown would mean serious interruption of important operations, danger to life, or failure to consummate critical objectives.

Castings made to these specifications will of necessity be more expensive than the standard commercial type and limit the number of vendors competent to live up to the requirements. They should not be called for where commercial quality would be satisfactory or where other means of manufacture are more suitable.

Purchasers drawings for this class of castings *must indicate* the character, degree, and location of critical stresses in the casting and must record all other information needed by the die caster to meet all service requirements.

Before starting production the vendor must submit sample castings of the correct chemical composition when, in the vendor's opinion, die and casting routine have been adjusted to produce consistently castings which will meet all requirements.

Committee C-8 on Refractories:

The accompanying list indicates the large number of recommendations from Committee C-8 on Refractories. New specifications and other recommendations are coming through at this time primarily because the committee meets in the late fall in connection with meetings of other ceramic organizations; consequently, its recommendations, if deferred until the A.S.T.M. Annual Meeting, would result in unnecessary delay, but another reason this year is so that the Refractories Manual, which is a compilation of all A.S.T.M. specifications and tests on refractories, plus other important material including surveys of industrial service can be as up to date as possible—a new edition is now being prepared.

The best way to give a conception of the nature of the tests or material covered in the new standards is to give in condensed form the scope clauses. Accordingly, they follow:

Tentative Methods of Test for Sieve Analysis and Water Content of Refractory Materials (C 92 – 43 T):

This method of test covers two procedures for sieve analysis and one for water content of refractory materials in the wet condition.

Wet Method of Sieve Analysis.—Water promotes the slaking of clays and helps to separate fine particles and to wash them from the larger grains. Consequently, this method will provide more reliable information than the dry method on products to which water is added and in which slaking would occur in normal industrial use. This method is recommended, therefore, for use with such materials.

Dry Method of Sieve Analysis.—The dry method is not as effective as the wet method in determining the amount of material present in the smaller particle sizes. It is recommended (*a*) for clays only when the slaking action of water is undesirable, (*b*) when the material is in the form of coarsely ground grog and calcine, (*c*) when the clay is to be used in such a way that the size of the ultimate particles is of secondary importance.

Water Content.—There is given a method for determining the water content of air-dry samples as received, so that the sieve analysis can be calculated on the dry basis. There is included also a method for obtaining the water content of other refractory products, such as plastic refractories and wet mixes.

Tentative Specifications for Air-Setting Refractory Mortars (Wet Type) for Boiler Furnace and Incinerator Service (C 178 – 43 T):

These specifications cover the wet type of air-setting refractory mortars for use in laying up fireclay refractories in boiler furnaces and incinerators.

Requirements are given for three classes of mortars. The mortar used should be of sufficient refractoriness for the type of service encountered. The temperature of the refractoriness test for each of the three classes is as follows: Super duty, 2910 F. (1600 C.); high heat duty, 2730 F. (1500 C.); intermediate heat duty, 2550 F. (1400 C.).

Tentative Method of Test for Combined Drying and Firing Shrinkage of Fireclay Plastic Refractories (C 179 – 43 T):

This method covers a procedure for determining the combined drying and firing shrinkage of high heat and super duty fireclay plastic refractories.

Tentative Method of Panel Test for Resistance to Thermal and Structural Spalling of Fireclay Plastic Refractories (C 180 – 43 T):

This method of test covers the procedures for determining the resistance of high heat and super duty fireclay plastic refractories to the separate and combined effects of structural and thermal spalling. The method makes use of the general requirements and procedure prescribed in the Method of Panel Test for Resistance to Thermal and Structural Spalling of Refractory Brick (A.S.T.M. Designation: C 38) and supplements that method by giving the detailed requirements of the procedures to be followed in testing high heat and super duty fireclay plastic refractories.

Tentative Method of Test for Workability Index of Plastic Fireclay Refractories (C 181 – 43 T):

This method covers a procedure for obtaining the workability index of plastic fireclay refractory by measuring the plastic deformation of a molded test piece when subjected to impacts. The data obtained serve as a measure of the facility with which the material can be rammed or pounded into place in a furnace.

The new methods C 92 will replace the existing Standard Method C 92 – 36 which has been subject to some criticism. The new methods C 179, C 180, C 181 provide separate test methods for procedures which are now covered in certain of the specifications developed by the committee.

Tentative Revisions of Standard Methods of Tests:

The tentative revisions of the Method of Test for Pyrometric Cone Equivalent of Refractory Materials (C 24 – 42) involve an eventual increase in the size of the tip of the cone and new material in the section on preparation of test cones is for the purpose of treating the clay samples to prevent bloating of the cone during actual testing. The heat treatment prescribed requires that after specialized preparation the material shall be heated in an oxidizing atmosphere to a temperature range of 1700 to 1800 F. for not less than 30 minutes. It is provided that after forming into a cone the sample may be given this heat treatment, but the procedure is not as effective as treatment of the powdered material.

The proposed modifications in the Method of Panel Test for Resistance to Thermal and Structural Spalling of Refractory Brick (C 38 – 42) require closer weighing of the test brick and a more restricted allowable temperature variation which is now practicable with present day pyrometric equipment, studies having indicated that it is entirely feasible in routine test work (the present permissible variation, "plus 20 C. and minus 25 C." is being reduced to read "± 10 C.").

The tentative revisions in the Method of Panel Test for Resistance to Thermal and Structural Spalling of High Heat Duty Fireclay Brick (C 107 – 42) and Panel Test for Resistance to Thermal and Structural Spalling of Super Duty Fireclay Brick (C 122 – 42) will eventually change the furnace gas pressure limits from the present figures of "0.3 to 0.6" to read "0.4 to 0.5 in. of water." Experimental work has shown that small differences in the gas pressure may result in an appreciable variation in amount of spalling. Now it is practicable to maintain the close limits indicated, by those who heat their furnaces with either gas or oil.

Committee D-11 on Rubber Products:

The Society's Committee D-11 on Rubber Products has set up a number of emergency alternate provisions to aid in procurement and conserve rubber and the two new emergency specifications covering Chloroprene Sheath Compound for Electrical Insulated Cords and Cables (ES – 28) and the same material when extreme abrasion resistance is not required (ES – 30) are in line with this work. Chloroprene, which is the chemical material covered, is more readily recognized under the name Neoprene as produced by E. I. du Pont de Nemours & Co. The development of these specifications has been accelerated because the War Production Board had advised the wire industry that the use of rubber for jackets will be prohibited and that Neoprene would be allocated. If specifications were not available, and there is at present no industrial standard, it was felt that the switchover would create a very chaotic situation, and although it is expected that as the synthetic rubber gets into still greater production that G.R.S. (buna S) will be used, it is not considered essential to cover this at present. Committee D-11 feels that where the new synthetic materials are being substituted for crude rubber or reclaim, separate standards should be established since the synthetics for electrical use may not be interchangeable with each other.

The new emergency specifications cover methods of tests, physical requirements, and include an oil immersion test and other requirements. The physical properties to which the material must conform are indicated in the accompanying Table A.

TABLE A

	ES – 28 (Heavy Duty Service)	ES – 30 (Where Extreme Abrasion Resistance Is Not Required)
Tensile strength, min., psi	1800	1200
Tensile stress at 200 per cent elongation, min., psi	500	...
Elongation at rupture, min., per cent	300	250
Set in 2-in. gage length, max., in.	1/8	1/8
Tensile strength after 96 hr. in oxygen bomb test, min., psi	1600	1000
Elongation after 96 hr. in oxygen bomb test, min., per cent	250	200
Tensile strength after 168 hr. in air oven test at 157 to 159 F. (69.4 to 70.6 C.) min., psi	1600	1000
Elongation after 168 hr. in air oven test at 157 to 159 F. (69.4 to 70.6 C.), min., psi	250	200
Depreciation in tensile strength and elongation after 18-hr. exposure to the oil immersion test at 249 to 251 F. (120.6 to 121.7 C.), max., per cent	35	40

Emergency Provisions in the Tentative Specifications for Rubber Sheath Compound for Electrical Insulated Cords and Cables (EA – D 532a):

It will be noted from this provision which is published in the back portion of this BULLETIN that the emergency tensile strength is being still further reduced to read "2500 psi." instead of the present emergency of "3000 psi." or the regular value of "3500," and the tensile strength after 48 hours in oxygen pressure test is to read

"2000" instead of the emergency "2500" or the regular strength after *96 hours* of "2500 psi."

Committee D-20 on Plastics:

The March BULLETIN, page 42, carried an announcement of very important work by A.S.T.M. Committee D-20 on Plastics in developing a series of new plastic specifications, and it was indicated also that four other new specifications were nearing approval. Three of these were given the sanction of the Society on March 20, the fourth on March 24. A list of the new specifications with abbreviated scope clauses follows:

Specifications for Cellulose Acetate Molding Compounds (D 706 – 43 T):

These specifications cover thermoplastic molding compounds consisting of cellulose acetate and plasticizers, with or without the addition of dyes and pigments, and suitable for compression, injection, or extrusion molding. They do not include special materials compounded for special applications. Four types are covered: general purpose, heat resistant, impact resistant, and moisture resistant.

Specifications for Cellulose Acetate Butyrate Molding Compounds (D 707 – 43 T):

These specifications cover thermoplastic molding compounds consisting of cellulose acetate butyrate having a butyrol content of not less than 35 per cent and plasticizers, with or without the addition of dyes and pigments and suitable for compression, injection, and extrusion molding.

Editor's Note.—The compounds covered by these specifications represent materials of a fairly wide flow temperature range. They have been designated as Types 1 through 6, the flow temperature decreasing as the type number increases. Therefore, Type 1 materials are the hardest and have the greatest dimensional stability while Type 6 materials are the softest and have the greatest impact strength. The in between types differ gradually between these two extremes.

Specifications for Rigid Sheets Made from Vinyl Chloride-Acetate Resins (D 708 – 43 T):

These specifications cover rigid plastic sheets made of vinyl chloride-acetate resins of approximately 90 per cent vinyl chloride content plus the necessary lubricants, stabilizers, pigments and dyes. These specifications do not cover special sheets compounded for special applications.

Plastics and Electrical Insulating Materials (Committee D-9 on Electrical Insulating Materials and Committee D-20 on Plastics):

In the very extensive A.S.T.M. work on plastics, Committee D-9 on Electrical Insulating Materials and Committee D-20 on Plastics cooperate. (There is considerable cross representation of membership also.) A case in point are the new Tentative Specifications for Laminated Thermosetting Materials (D 709 – 43 T), which have been under consideration for some time and have been urgently requested by a War Committee on Radio which is working under the War Production Board. Certain excerpts from the specifications will indicate its scope:

The properties included in these specifications are those required to identify the types and grades of laminated thermosetting materials covered. There may be other requirements necessary to identify particular characteristics. These will be added to the specifications as their inclusion becomes generally desirable and the necessary test data and methods become available.

A laminated thermosetting material is defined as one consisting of two or more plys or layers of sheet fillers bonded by a thermosetting type of synthetic resin. Examples of such sheet fillers are cellulose paper, asbestos paper, cotton fabric, asbestos fabric, glass fabric, wood veneer, etc.

These specifications do not cover special grades of material for radio or similar critical electrical applications. These grades are covered by A.S.T.M. Specifications D 467 – 40 T and D 616 – 41 T.

Editor's Note.—Three types and twelve grades of material are covered. Six grades are cellulose-paper-base type; four, cellulose fabric-base type; and two, asbestos-base type.

Thermometers:

The kinematic viscosity thermometers which are covered in the Tentative Specifications for A.S.T.M. Thermometers (E 1 – 43 T) under the designation 28 F., 29 F., and 30 F., are very difficult to fabricate because of the high degree of precision which is necessary in using the thermometers in the Test for Kinematic Viscosity (D 445 – 42 T). This requires that temperatures be determined within plus or minus 0.025 F. To help in expediting production of these thermometers, the section in charge, of Committee E-1 on Methods of Testing, has recommended modifications in the dimensions involving total length, from bottom of bulb to first graduation, top of thermometer to top graduation, and the ice point (bottom of bulb to 32 F.) These requirements have been approved by Committee E-10 on Standards.

Partial List of Emergency Alternate Federal Specifications

FROM THE VERY large list of Emergency Alternate Specifications received at A.S.T.M. Headquarters there has been selected many which it is believed would be of concern to a reasonable cross-section of the Society's membership and the titles of these are given below. Constantly these emergency specifications are being issued, some to supersede previously issued emergency documents —in all cases, of course, the object is to expedite procurement or to conserve strategic or critical materials.

Partial List of Emergency Alternate Federal Specifications

Specification Number	Description
E-FF-C-436	Clips; Paper, Wire (superseding May 20, 1942)
E-HH-G-76	Gaskets; Asbestos, Metallic-Cloth (superseding April 21, 1942)
E-HH-P-31	Packing; Asbestos, Metallic-Cloth, Sheet (superseding June 5, 1942)
E-HH-P-36	Packing; Asbestos, Rod (High-Pressure) (superseding April 21, 1942)
E-HH-P-46	Packing; Asbestos, Sheet, Compressed (superseding November 20, 1942)
E-HH-P-51	Packing; Asbestos, Valve-Stem
E-HH-P-151a	Packing, Rubber; Cloth-Insertion (superseding August 7, 1941)
E-HH-T-111a	Tape; Rubber, Insulating (superseding June 23, 1942)
E-LLL-L-351a	Linoleum; Battleship (superseding January 21, 1943)
E-LLL-L-359	Linoleum; Inlaid, and Molded (superseding January 21, 1943)
E-LLL-L-367	Linoleum; Plain, Jaspe and Marbleized (superseding January 21, 1943)
E-QQ-S-781a	Strapping, Flat; Steel (superseding May 15, 1941)
E-RR-O-376	Oilers and Fillers; Hand (superseding July 7, 1942)
E-T-R-601a	Rope; Manila (superseding February 9, 1942)
E-UU-P-121c	Paper; Bond, White and Colored (superseding January 1, 1943)
E-UU-T-101b	Tape, Gummed; Mending, Reinforcing, and Securing (superseding June 23, 1942)

Behavior of Glazing Material Subjected to Explosion[1]

By F. W. Adams[2]

EDITOR'S NOTE.—Although this authoritative paper may be of most direct concern to those in the glass, plastics, and related fields, it undoubtedly will be of general interest to almost every BULLETIN reader. It describes important studies carried out by the Multiple Industrial Fellowship on Plate Glass Technology at Mellon Institute to determine the effect of bomb explosions on glass and other glazing materials. Since only by an actual explosion could the effect be ascertained, a satisfactory procedure was developed which involves the erection of a small frame house where charges of dynamite could be detonated at specified distances from a large window in front of the building. Many different materials and conditions were investigated with over 600 explosions. The results were recorded with slow-motion camera. Much data of value in the design and protection of windows have been developed and made available to those directly concerned.

This paper also represents a valuable result of meetings sponsored by district committees, the Pittsburgh District Committee having arranged through Dr. Adams to cover the subject at the meeting on January 11, 1943, and with his close cooperation the manuscript and interesting illustrations were made available for the BULLETIN.

REPORTS OF VARIOUS experiences in England state that as many as eighty per cent of the casualties from bombing raids were attributable to flying glass.

To be forewarned is to be forearmed. It is hoped that the facts presented here, showing the results of actual explosions in causing the breaking and scattering of glass, will assist us in adopting suitable protective measures. Once the facts are known, there can be no excuse for exposing ourselves and our neighbors to dangerous conditions. The opportunity to provide reasonable protection in otherwise hazardous locations, which, for special reasons, it is necessary to protect, exists and is clearly shown in the results of these tests.

SELECTION OF TEST METHOD

In planning the tests, it became evident that the only satisfactory method of determining the effect of an explosion on glazing materials is to subject the glazing materials installed under simulated actual conditions to the effect of an actual explosion. A small frame house, Fig. 1, 10 by 8 by 9 ft. high was erected on the test location and provided with a suitable window opening for test pieces and a door in the back for easy access. A window opening 48 by 84 in. was selected, because it represents the largest commercial size of laminated safety glass. This size of window also lent itself to the insertion of standard sizes of steel sash window and wood sash window, Fig. 2. Sizes of glass tested included 12 by 18 in., 28 by 32 in., 48 by 48 in., and 48 by 84 in. The explosive chosen for this work was selected because of uniformity and known explosive characteristics. U. S. Bureau of Mines standard 40 per cent nitroglycerine dynamite has been used by the Bureau of Mines for a variety of test work. Through the kindness of the Bureau, who supplied us with the specifications,

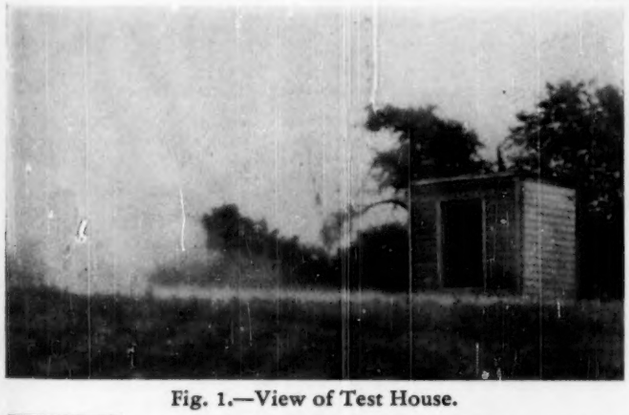


Fig. 1.—View of Test House.

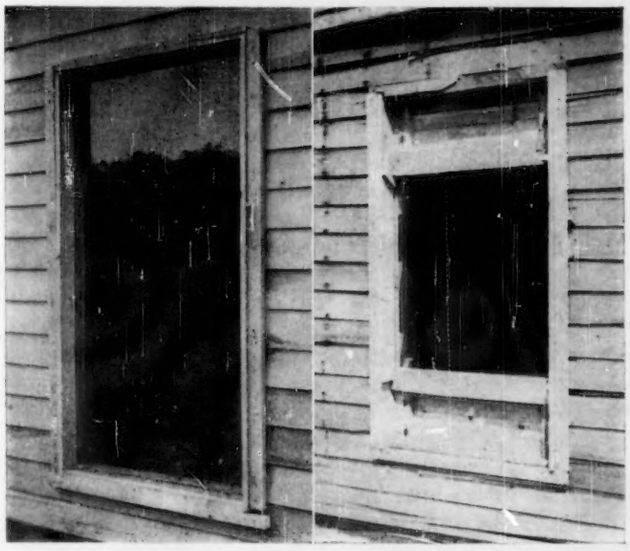


Plate glass 48 by 84 in. Plate glass 48 by 48 in.

Steel sash window 12 by 18 in. Wood sash window 28 by 32 in.

Fig. 2.—Types of Windows Used.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication, or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

[1] Presented at a meeting sponsored by the A.S.T.M. Pittsburgh District Committee, Pittsburgh, Pa., January 11, 1943.

[2] Chemical Engineer, Pittsburgh Plate Glass Co., Pittsburgh, Pa.

we were able to obtain this dynamite for use in our tests. The results may, therefore, be readily correlated with those of other tests carried on with this standard explosive. A small number of tests were also run using TNT instead of dynamite.

Conditions of explosive force were varied by the choice of varying amounts of dynamite between $^1/_2$ lb. and 5 lb., detonated at distances from the window of between 8 ft. and 80 ft. The explosive was tied to a light bamboo stick at a distance of two feet above the ground to permit of its unobstructed detonation. The test house was located on a level field to prevent disturbing reflections from complicating the interpretation of the results. The dynamite was detonated by a No. 6 electric blasting cap placed in the end of the stick of dynamite away from the building and electrically fired from a remote location.

Glasses representative of the various types in common use in homes, offices, factories, stores, automobiles, buses, and trains were used in the tests. These included single-strength and double-strength window glass, plate glass, wired glass, tempered glass, and laminated safety glass. Various methods of treating glass such as coating with liquids, tapes, or fabrics, to render it less hazardous under bombing conditions were also examined. Special laminated glasses and double glazed constructions of various kinds were tested. In addition a miscellaneous group of other materials including glass blocks, cellular glass, plastics, plywood, pressed wood, and asbestos cement board were subjected to explosions.

To provide a permanent record and permit more detailed study of the results, slow-motion moving pictures (64 frames per second) were taken of all shots. Duplicate camera setups were used so that any failure of one camera would not result in a lack of valuable records. Closeups of the results of each explosion were taken with the movie camera as well as a large number of significant "stills." This pictorial record was supplemented by copious notes showing the conditions and results of each test.

Every precaution was taken to insure the safe handling of explosives throughout the work according to the best field practice.

Suitable precautions were also taken to protect, by goggles and other suitable means, the men carrying out the experiments from the hazard of handling broken glass. It is gratifying to say that no lost-time accidents of any kind were experienced during the three-month period during which these tests were made.

612 shots were made during these tests.

Presentation of Results

It had previously been found by others[3] that explosive force can be correlated as the ratio of the cube root of weight of explosives to the square root of distance from the explosion. It was found that the application of this formula to the results of these tests is fully justified by the experimental values obtained, and this formula has been used throughout for translating test results to equivalent bombing conditions.

For the most important types of glass or glazing material tested, there was determined:

1. The minimum explosive force which will cause glass fracture.
2. The maximum force which any piece of the glass will resist without fracture or failure.
3. The average explosive force causing fracture or failure.
4. The effect of high explosive forces on scattering of the glass.

These four pieces of information suitably define the effect of explosions on a glazing material. A few glazing materials were tested for only one or more of these conditions.

In any experimental work of this nature a certain amount of variation in results occurs. However, the small spread between the minimum explosive force that will cause glass fracture and the maximum explosive force that any piece of the same type of glass will resist without fracture makes the use of the average explosive force a desirable means for presenting summarized results.

To assist a more ready visualization of the results, they are presented on the basis of the equivalent distance at which a 500-lb. demolition bomb, containing 250 lb. of high explosive, would have the same explosive force. It is interesting to note, by way of confirmation, that the average distance at which $^1/_4$-in. plate glass is found to break checks very closely with the distance set down in the American Table of Distances regarding minimum distance at which an unbarricaded magazine to hold 250 lb. of explosives may be located from an inhabited building.

Fig. 3.—Breakage of Single Strength Window Glass Subjected to a Light Explosion.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 2500 ft.

Fig. 4.—Breakage of Double-Strength Window Glass Subjected to a Light Explosion.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 1200 ft.

[3] This method of correlation was suggested to us by the U. S. Bureau of Mines. Acknowledgment of the advice and assistance rendered us in this work by the staff of the U. S. Bureau of Mines should be made at this point.

Summary of Results

Usual Glasses:

Most of the glass encountered in our daily life in our homes, offices, and factories is window glass, commercially identified as either single strength or double strength. The explosive force equivalent to a 500-lb. demolition bomb falling 2500 ft. away is just sufficient to cause breakage of some windows (Fig. 3). This distance is equivalent to about six city blocks, or nearly half a mile. Of course, it should be realized that under ordinary conditions all of the windows of a house are not equally susceptible to breakage. Houses, trees, and other obstructions may affect the force of the blast in such manner as to deflect it or concentrate it, causing occasional windows to be broken and others to be spared. These unpredictable results are particularly striking at the edge of the danger zone, where only the minimum explosive force to cause breakage is present. The average force required to break window glass was found to be equivalent to a 500-lb. demolition bomb exploding at a distance of 1900 ft. for single strength and 1200 ft. for double strength (Fig. 4).

Plate glass, with which we are familiar in store windows, in the windows of many doors, and in many office partitions, is considerably thicker than window glass and consequently is stronger. The average explosive force required to break plate glass corresponds to that of a 500-lb. bomb at a distance of 400 ft. or about a block away (Fig. 5). For both plate glass and window glass the size of the window has very little effect on the explosive forces required to cause breakage.

Wired glass is a familiar sight, particularly around elevators, skylights, fire escapes, and other places where a broken window might engender a special hazard. The wire mesh running through this glass gives it added strength and holds it in the frame even after it is cracked or broken, but its strength is also its weakness because the wire renders the glass susceptible to cracking when subjected to a light explosion. An explosive force equivalent to a 500-lb. bomb exploding at a distance of 1200 ft. is sufficient to crack wired glass in larger sizes (Fig. 6). While small chips may be broken off and blown around, no scattering of the glass occurs at this low-explosive force. Smaller sizes (12 by 18 in.) are more resistant to explosive blast, cracking at about the same explosive force as plate glass (300 to 400 ft.). Complete failure of wired glass, in which it is torn or split and pieces are thrown from the window, occurs at a higher explosive force corresponding to a 500-lb. bomb detonating 250 ft. away. Under these conditions the glass breaks into sizable pieces with sharp, cutting edges which offer a real hazard to persons in the vicinity.

Fig. 5.—Breakage of Plate Glass Subjected to a Moderate Explosion.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 400 ft.

Fig. 6.—Breakage of Wired Glass Subjected to a Light Explosion.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 1200 ft.

Glass broken by explosive blast presents its major hazard to personnel by the falling and scattering of sharp splinters and knife-like pieces. The direction in which the fragments will be scattered is generally unpredictable. In the majority of tests conducted, between 40 per cent and 60 per cent of the glass was thrown both into the building and out of the building (Fig. 7). In a few isolated cases of high-explosive force over 90 per cent of the glass was thrown into the building.

No satisfactory method of preventing the glass from breaking has been devised. Opening a sash window a few inches at top and bottom reduces by about 20 per cent the likelihood of its breakage under light explosive blast; it has little, if any, effect on the scattering of the glass fragments. A piece of light plywood fastened to the window frame either inside or outside offers a similar slight protection to the glass, but increases the violence of its scattering.

Methods of Treating Usual Glasses to Reduce Hazards from Scattering:

Many methods for reducing or controlling the scattering of glass have been proposed. To be effective such a method must hold the glass together, even after it has

been broken by a moderately heavy explosive blast.

Liquid coatings which may be painted on the surfaces of window glass have been suggested for such use. Unfortunately, such materials are of no practical value for reducing glass scattering to afford a reasonable degree of safety.

Tape crisscrossed on a window to reduce scattering may have some merit, depending on the strength of the tape, its arrangement, and its adhesiveness. Paper tape is of little value. Strong cloth tape well adhered to the glass on a close spacing, crisscrossed, and overlapping the sash at each end, will hold much of the glass together. Glass pieces roughly the size of the uncovered glass between tapes may still be scattered (Fig. 8). It is therefore wise, when using tape, to avoid open spaces larger than 2 in. square. Some visibility through the window is afforded, vision through these openings is clear and a fair degree of protection is obtained. While other types of tape have been suggested, their availability and usefulness are questionable.

Much better protection is obtainable by complete coverage of the window with a textile fabric, well adhered to the glass and sash. This treatment permits light transmission, although it obstructs vision, but, most important, it is effective in reducing glass scattering. A window covered with cheesecloth, adhered with paperhanger's paste (flour paste), was subjected to an explosive force equivalent to a 500-lb. bomb detonated at 300 ft. The results are shown in Fig. 9, where the lower sash was blown from the frame and the middle bar of the upper sash was broken by the blast. The glass was broken and the fabric was torn in both sashes, but practically no glass was separated from the fabric or scattered. This is about the best performance that can be expected from such a treatment.

Window Glass. Explosion equivalent to a 500-lb. demolition bomb at a distance of 400 ft.

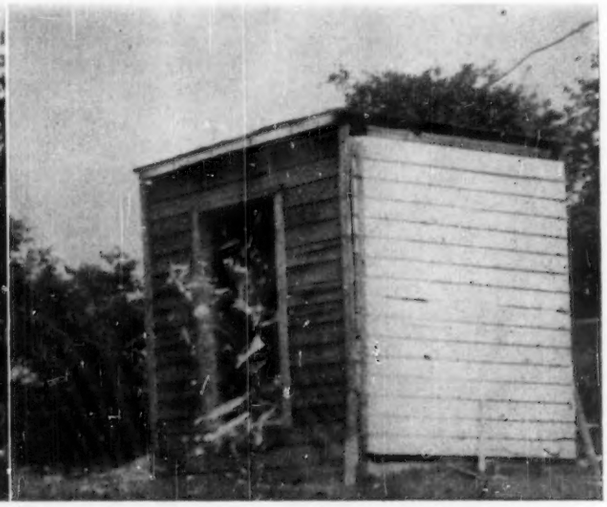


Plate Glass. Explosion equivalent to a 500-lb. demolition bomb at a distance of 475 ft.

Plate Glass Thrown Outward. Explosion equivalent to a 500-lb. demolition bomb at a distance of 350 ft.

Plate Glass Thrown Inward. Explosion equivalent to a 500-lb. demolition bomb at a distance of 350 ft.

Fig. 7.—Scattering of Glass Due to Explosive Blast.

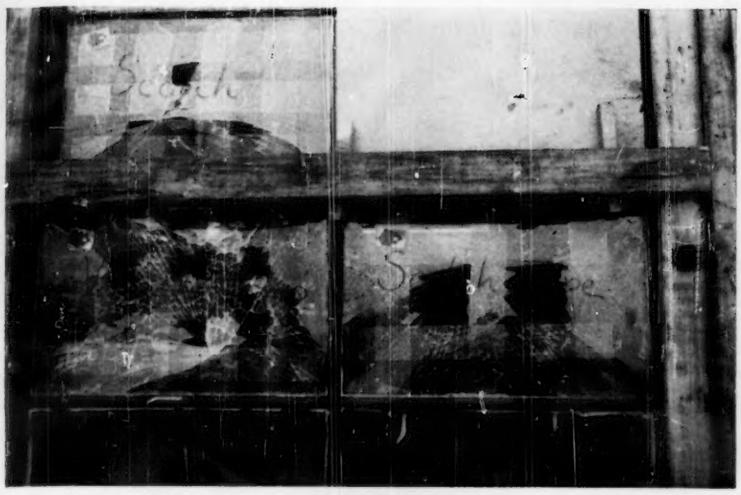


Fig. 8.—Scattering of Taped Window Glass Subjected to a Light Explosion.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 800 ft.

Fig. 9.—Failure of Fabric-Covered Window Glass Subjected to a Moderate Explosion.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 300 ft.

Prevention of glass scattering may also be effectively accomplished by placing a heavy wire screen over the window and close to the glass. The results of an explosion equivalent to the blast from a 500-lb. demolition bomb at a distance of 220 ft. from a plate-glass window covered with $^1/_2$-in. mesh hardware cloth are shown in Fig. 10. Scattering is prevented only in the direction of the screen, so that coverage on both sides of the window is necessary for complete protection. The use of metal for such a treatment is justified only where unobstructed vision of important personnel is essential.

Safety Glasses:

Special glasses for accomplishing the same results offer distinct advantages, but require removal of existing glass and reglazing. Tempered plate glass and laminated safety glass are very resistant to blast, particularly in the smaller sizes. Even in large sizes (48 by 84 in.) tempered plate glass is undamaged by explosions equivalent to a 500-lb. bomb falling within 250 ft. of the window. At an explosive force equivalent to this bomb at 220 ft., tempered plate glass of this size shatters completely into small cubical fragments of low scattering power, presenting no long, sharp, cutting edges (Fig. 11). Such fragments might prove undesirable in the vicinity of machinery, instruments, or materials like food products and obviously could cause serious eye injuries, although personal injury involving lethal lacerations would be negligible. With an explosion heavy enough to cause the breakage of tempered plate glass, the likelihood of flying metal fragments from the bomb casing striking the window is appreciable. Impact of shell fragments on such a glass may likely cause its complete failure with the same characteristic type of break. Small panes (12 by 18 in.) of tempered plate glass when stop-glazed in steel sash have successfully resisted an explosive blast equivalent to a 500-lb. bomb at 95 ft. Such a blast is destructive to most wood or steel sash, so that special precautions are necessary to take full advantage of the strength of this material. If the tempered glass is held in place by common glazing clips it may be pushed out of the sash and blown in in one piece to fall harmlessly on the floor or to fell the hapless individual who is standing in its path. Stops or angle irons bolted to the sash give a more positive means of keeping the glass in place, at least until the explosive force is sufficient to shear the bolts.

Fig. 10.—Use of Wire Screen for the Prevention of Scattering of Plate Glass Subjected to a Heavy Explosion.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 220 ft.

Laminated safety glass is familiar to all of us in the windshields and windows of most automobiles and commercial airplanes and in the windows of some of the more modern types of buses, trolleys, and trains. It is especially designed for transportation equipment, but is also well

Small cubical fragments thrown outward.

Small cubical fragments thrown inward.

Fig. 11.—Breakage of Tempered Plate Glass Subjected to a Heavy Explosion.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 220 ft.

adapted to resist high explosive forces without failure. Its point of initial breakage or cracking of the glass coincides with the breaking point of plate glass, corresponding to a 500-lb. bomb distance of 400 ft. As shown in Fig. 12, this explosive force permanently damages the glass and interferes somewhat with its visibility, but does not remove it from the frame. In fact, such a glass has taken repeated explosions of this force without experiencing further failure. At a high explosive force, equivalent to a 500-lb. bomb detonating at a distance of 170 ft., laminated safety glass fails (Fig. 13). Its failure involves little danger to personnel, because no large, cutting pieces of glass are detached from the plastic center of the lamination. Failure usually occurs as a tearing loose from the frame or splitting and falling as a blanket into the building. Hazard from eye injury or damage to machinery due to flying glass is unlikely in such a failure of laminated safety glass.

Fig. 12.—Breakage of Laminated Safety Glass Subjected to a Moderate Explosion.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 400 ft.

Special Laminated Glasses:

A variety of special laminated safety glasses have been designed for selected applications. These include: (1) a special laminated safety glass with double thickness (0.030 in.) of plastic, (2) a special laminated glass composed of tempered glass, plastic, and annealed plate glass, (3) a special laminated glass (Flexseal) with a center layer of thick (0.060 in.) plastic extending beyond the two sheets of glass comprising the sandwich.

Increasing the layer of plastic to double its normal thickness does not change the blast resistance of a laminated safety glass. The glass is still broken without failure at an explosive force equivalent to a 500-lb. bomb at a distance of 400 ft. Complete failure of this special safety glass involving splitting or tearing loose from the frame

Fig. 13.—Failure of Laminated Safety Glass Subjected to a Heavy Explosion.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 170 ft.

Fig. 14.—Special Laminated Glass Resists Blast of Heavy Explosion.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 145 ft.

also occurs in the same manner and at the same high explosive force as laminated safety glass, namely, a blast equivalent to a 500-lb. bomb detonated at 170 ft.

A special laminated glass composed of tempered glass, plastic, and annealed plate glass is somewhat more resistant. As might be expected, breakage of the annealed plate glass occurs with moderate explosive force, regardless of which side of the glass is presented to the explosion.

Fig. 15.—Special Laminated Glass Resists Blast of Heavy Explosion. Breakage without Failure.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 110 ft.

Fig. 16.—Effect of Heavy Explosion on a Glass-Block Panel.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 130 ft.

Initial breakage of this laminated glass is better than regular laminated safety glass; complete failure does not result until a considerably higher explosive force is exerted. Thus, this glass is first broken at an explosive force corresponding to the detonation of a 500-lb. bomb, at a distance of 280 ft.; failure occurs at an equivalent distance of 130 ft. The nature of the failure is similar to that of regular laminated safety glass.

Exceptional resistance to breakage and failure is shown by the Flexseal type of special laminated safety glass (Fig. 14). This glass may be installed in the window either by drilling the plastic edge and bolting it between steel plates or angles into the frame, or by clamping the plastic edge tightly into the frame; both methods give satisfactory results. Two designs of this type are available: one made with annealed glass on both sides of the plastic, the other with semitempered glass on both sides. The reactions of these two designs to an explosive force are distinguished by their difference in resistance to initial breakage: the annealed design breaks at an equivalent distance of the 500-lb. bomb of 550 ft.; the semitempered design

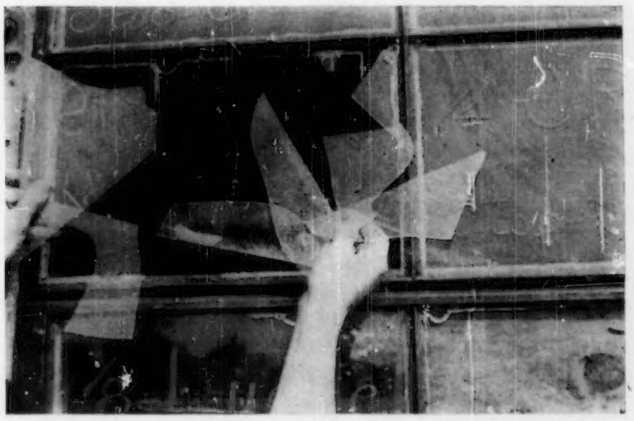
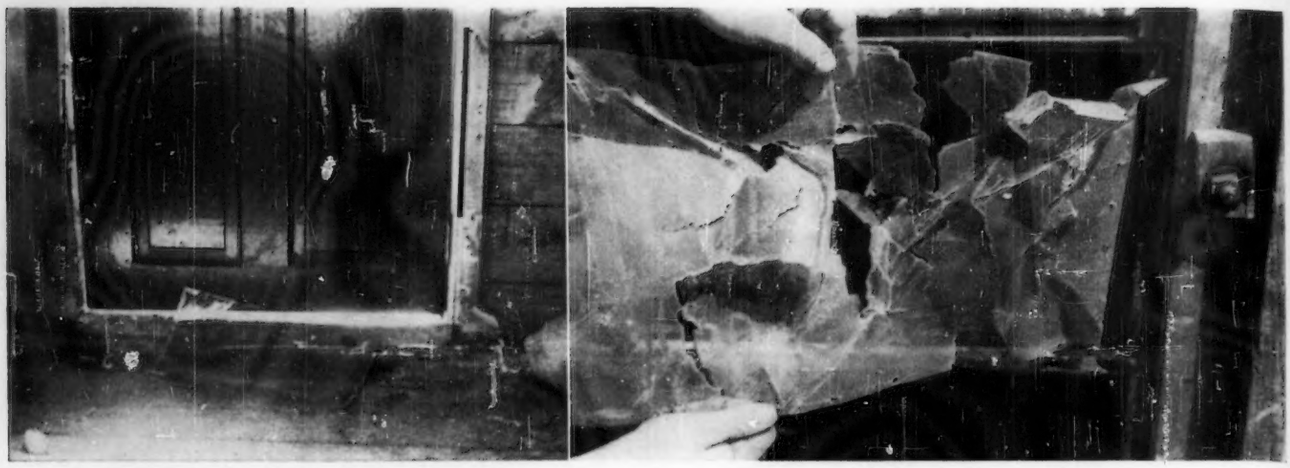


Fig. 17.—Typical Plastic Break from Explosive Blast.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 500 ft. Farthest piece found 62 ft. from window.



Explosion equivalent to a 500-lb. demolition bomb at a distance of 300 ft.

Explosion equivalent to a 500-lb. demolition bomb at a distance of 110 ft.

Fig. 18.—Effect of Explosive Blasts on Wire Reinforced Plastic.

successfully resists an explosive force equivalent to 145 ft. without damage of any kind. Both designs of window have resisted the highest explosive forces to which they have been subjected: namely, 95 ft. (not shown). A typical result at 110 ft. is shown in Fig. 15. Explosions closer than this are approaching the definition of a "direct hit" and, except under conditions of unusual building construction, may be expected to have lethal results on personnel. This type of glass, because of its high resistance to explosive forces, is particularly adapted to military use. It does not, however, offer complete protection against flying fragments, which can only be expected from bullet-resisting glass.

Special Constructions:

There are many applications where windows of special construction are encountered. Double-glazed windows consisting of two plates of glass separated by an air space and glazed into a single sash are installed in many offices and factories where air-conditioning is practiced. Other double-glazed units, involving the use of tempered glass or laminated safety glass in combination with plate glass or with each other in similar construction, are widely used in railway equipment. Four representative types were tested including: (1) plate glass with plate glass, (2) plate glass with tempered glass, (3) tempered glass with laminated safety glass, and (4) laminated safety glass with laminated safety glass.

General conclusions drawn from these tests show that breakage of the weaker glass component of the double-glazed unit occurs at the same explosive force as if this component were glazed by itself.

Thus, the plate glass of constructions (1) or (2) breaks at an explosive force equivalent to a 500-lb. demolition bomb detonated at a distance of approximately 400 ft. Either inner or outer glass of the plate-plate construction may fail at this explosive force; a second force of the same magnitude usually causing failure of the other glass. Plate glass in combination with tempered glass breaks at the same explosive force on the inside of such a window as it does on the outside. Heavier explosions break both panes of glass throwing glass in both directions. The plate glass–tempered glass combination breaks under a slightly less severe blast than is required to break tempered glass if glazed alone. Thus, an explosive force equivalent to a 500-lb. demolition bomb at 250 feet will break and scatter such a unit.

The laminated safety glass double-glazed units of types (3) and (4) show greater strength under heavy explosive blast than a single pane of either glass. Thus, while breakage of the laminated glass and scattering of the tempered glass may occur, double-glazed units of both of these types have resisted explosive forces equivalent to a 500-lb. bomb at a distance of less than 160 ft. Transportation equipment, double-glazed with windows of these types, is well protected against the effects of blast.

Other Materials:

A variety of other materials have been suggested for glazing purposes or for closing window openings in exposed locations. Some of these materials have been subjected to explosive blast to furnish an approximate evaluation of possible hazards involved in their use.

Glass Blocks.—Glass blocks erected as a 2-ft. square panel and set in a wooden frame were exposed to an explosive force equivalent to a 500-lb. bomb at a distance of 130 ft. Extensive damage occurred as is shown in Fig. 16. It will be noted that the center block in the panel was not cracked or broken and that parts of two other panels remained. Extensive scattering of dangerous glass pieces was experienced. Evidently, glass-block panels cannot be expected successfully to resist such a heavy blast. The fact that one block was undamaged indicates that small glass block panels will probably be safe at twice this distance: namely, 260 ft., although a guess based on such meager data is questionable.

Plastics.—Plastics that have been suggested as possible substitutes for glass in windows are susceptible to breakage in a manner and degree analogous to glass (Fig. 17). An extensive series of tests show the following average breaking distances for several types and thicknesses of transparent plastics glazed in steel sash:

Plastic Thickness	Equivalent 500-lb. Bomb Distance, ft.
1/8 in., clip-glazed or stop-glazed	700
3/16 in., stop-glazed	220
1/4 in., clip-glazed	275
1/4 in., stop-glazed	180

Fig. 19.—Effect of Heavy Explosive Blast on Plywood Panel.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 250 ft.

Fig. 20.—Effect of Moderate Explosive Blast on Masonite.
Explosion equivalent to a 500-lb. demolition bomb at a distance of 300 ft.

It will be noticed that the method of glazing has a profound effect on the performance of the thicker plastics, but no effect on the 1/8-in. plastics. A further interesting fact is the great distance to which fragments of plastic are projected when breakage occurs: sharp knife-like pieces have been scattered to distances of from 40 to 60 ft. under conditions of moderate or heavy explosion. Replacement of glass with plastics 1/8 to 1/4 in. thick does not, therefore, effectively remove the hazard from explosive blast. Thinner plastic sheets were not tested.

A very thin plastic, reinforced with wire netting, has been proposed for certain temporary glazing requirements. Under moderate explosive force, corresponding to a 500-lb. bomb at 300 ft., this was blown out of the sash and crumpled; under a heavy explosive force, corresponding to a 500-lb. bomb at 110 ft., the plastic was badly damaged as shown in Fig. 18.

Plywood and Fabricated Boards.—Plywood and fabricated boards offer another means of closing window openings, but, of course, with the complete exclusion of light. Their use involves removal of the glass and its replacement with the board.

Plywood 1/4 in. thick is of limited value for this purpose. At an explosive blast equivalent to a 500-lb. demolition bomb at a distance of 300 to 800 ft., depending on the method of fastening employed, 1/4-in. plywood is blown from the steel sash into the building. At higher explosive forces breaking of the plywood, see Fig. 19, occurs.

Pressed wood sheets (Masonite) were tested in thicknesses of 1/8 and 1/4 in. The 1/8-in. material blew in over about the same range as plywood (300 to 800 ft.) and failed at an equivalent bomb distance of 300 ft. (Fig. 20). The 1/4-in. pressed wood, being more rigid, was less easily blown in and was not broken at an explosive force equivalent to a 500-lb. bomb at 300 ft.

Asbestos cement board (Transite) was also tested in 1/8-in. and 1/4-in. thicknesses. The 1/8-in. thickness was broken and blown from the window at explosive forces equivalent to 500-lb. bomb distances of 500 to 800 ft. The scattered pieces of this board lack the cutting edges of broken glass, but are sufficiently dangerous to render the use of this thickness of asbestos cement board undesirable. In the 1/4-in. thickness the board was blown from the sash at equivalent bomb distances as great as 600 ft. and breakage occurred at 400 ft.

Of the three types of board tested, the 1/4-in. pressed wood sheets offer the greatest resistance to blast. In locations where replacement of existing plate or window glass with a light excluding material is necessary, this type of board can be recommended. If a noncombustible material is required, 1/4-in. asbestos cement board has a limited value. Plywood (1/4 in.), pressed wood (1/8 in.), and asbestos cement board (1/8 in.) cannot be recommended for this use. Only under very exceptional conditions should the use of any of these materials to replace tempered glass or laminated safety glass be permitted

WPB Cement Order Modified

As of February 16, 1943, the Portland Cement Limitation Order L-179 was revised by removing the ban upon the assignment of storage space to customers, and certain restrictions previously applied to the testing of portland cement will no longer be applicable. Specifications for testing of portland cement remain the same, but the amended order no longer requires that such tests must be made exclusively by the National Bureau of Standards or by a laboratory designated by that Bureau.

A provision of the order which reduced to three the number of types of cement that may be manufactured remains unchanged.

Earmarking of storage bins for particular customers was prohibited under the original order with a view to increasing production of portland cement by releasing all available bin capacity within the industry for that purpose. This increase in production was sought in order to meet unusual demand in critical war projects during an earlier period. A lessened demand at the present time renders unnecessary a continuance of the restrictions upon storage facilities and testing procedures.

Extensive 1943 Symposium on Radiography Published

Committee E-7 Sponsors 300-Page Volume with 19 Technical Papers

FREQUENTIY IN describing an A.S.T.M. publication or methods of distributing it, and occasionally in attempting to describe briefly many of the Society's technical problems, one becomes quite involved. (One member of the Staff frequently exclaims "I wish some problem would come along that we could describe simply.") Thus, to say that the recently issued extensive book entitled 1943 Symposium on Radiography is not the latest Symposium on Radiography held by the Society, but this plus other papers, calls for an explanation.

Here is the explanation: The current book issued as of May 15 is indeed based on the 1942 Symposium on Radiography held as a feature of the 1942 Annual Meeting with some 13 technical papers. *But*, the committee in charge (Lars Thomassen, *chairman*, John T. Norton and Hermann E. Seemann) felt that those papers which dealt with Radiography in the 1936 Symposium (it also covered X-ray diffraction) should also be included in the latest published volume, and one paper from the ASTM BULLETIN was likewise added, so we have an equation:

> 1943 Symposium on Radiography = 1942 Symposium on Radiography + selected papers from the 1936 Symposium + a paper from the ASTM BULLETIN + many other intangibles—editorial supervision on the part of the special committee, etc.

To go back a bit—in 1936 the Society held one of its most extensive technical symposiums covering Radiography and X-ray Diffraction, which in turn had been preceded by an extensive round table discussion the year before. These papers were formalized in the 1936 Symposium. This material subsequently published represented the first book in English covering this timely subject. It was widely distributed, and the war emergency focusing attention on the importance of radiographic inspection and nondestructive testing of material soon exhausted the edition.

Meanwhile the committee had been developing another symposium which as indicated above featured the 1942 A.S.T.M. meeting. These 13 papers are published in the 1942 *Proceedings*, but the committee in charge acting for A.S.T.M. Committee E-7 on Radiographic Testing (H. H. Lester, Watertown Arsenal, *chairman*) wanted to make the book as valuable as possible, and consequently included, either in condensed form or as revised, certain papers from the previous symposium and added an important contribution dealing with safety that appeared as a paper in the ASTM BULLETIN.

In the near future there will be sent to each A.S.T.M. member and committee member a detailed prospectus combined with an order blank, giving a synopsis of the papers which make up this publication and provide members and others who have not previously ordered a copy a convenient method of procuring this book.

The price to members of the Society is $3, to nonmembers $4. It is printed on special stock to bring out radiogram details and is substantially bound in red binding.

A complete list of the papers in this symposium and authors follows:

Preface—Lars Thomassen

1936 Symposium Papers

The Principles of the Radiographic Process—John T. Norton
Foundry Applications of Radiography—Earnshaw Cook
Miscellaneous Applications of Radiography and Fluoroscopy—Herman E. Seemann
Gamma-Ray Radiography and Its Relation to X-ray Radiography—Norman L. Mochel
Appendix: Instructions for Radiography with Radium—C. W. Briggs and R. A. Gezelius
The Problem of Radiographic Inspection—H. H. Lester

1942 Symposium Papers

Some Applications of X-ray Inspection to Production Problems—Don M. McCutcheon
Radiography of Welds and Weldments—R. E. Lorentz, Jr.
Some Calibration Data and Scatter Measurements for the Radiography of Magnesium Aircraft Castings—L. W. Ball
A Correlation of the Mechanical Properties and Radiographic Appearance of Magnesium Alloy Castings—R. S. Busk
A Million-Volt Portable Radiographic X-ray Unit—E. E. Charlton and W. F. Westendorp
High-Voltage X-rays in the Boiler Shop—O. R. Carpenter
The Gamma-Ray Radiography of Welded High Pressure Power Plant Piping—R. W. Emerson
An Investigation of the Apparatus Used in Radium Radiography—L. W. Ball and D. R. Draper
An Exposure Meter for X-ray Radiography—Herbert Friedman and Arthur L. Christenson
A Study of Cassette Design for the Radiography of Aircraft Castings—L. W. Ball
Equivalent Penetrameters in Radiographic Testing—Robert J. Schier and Gilbert E. Doan
Precision Radiography—III—Robert J. Schier and Gilbert E. Doan
X-ray Film Evaluation—Vance Danford

Industrial X-ray Protection—Lauriston S. Taylor
Proposed Recommended A.S.T.M. Industrial Radiographic Terminology

Calendar of Society Meetings

(Arranged in Chronological Order)

AMERICAN OIL CHEMISTS SOCIETY—May 12–14, New Orleans, La.

AMERICAN IRON AND STEEL INSTITUTE—52nd General Meeting, May 27, Waldorf-Astoria Hotel, New York, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—Semi-annual Meeting, June 6–8, William Penn Hotel, Pittsburgh, Pa.

AMERICAN ELECTROPLATERS' SOCIETY—Thirty-first Annual Convention, June 7–9, Hotel Statler, Buffalo, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS—War Matériel Meeting, June 9–10, Book-Cadillac Hotel, Detroit, Mich.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Semi-annual Meeting, June 14–16, Los Angeles, Calif.; Annual Meeting, November 29–December 3, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE—June 14–19, Corvallis, Oregon.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION—June 18–20, Chicago, Ill.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Summer Convention, June 21–25, Cleveland, Ohio.

American Society for Testing Materials—Forty-sixth Annual Meeting, June 28–July 2, William Penn Hotel, Pittsburgh, Pa.

NATIONAL SAFETY COUNCIL—October 5–7, Sherman, La Salle, and Morrison Hotels, Chicago, Ill.

Progress in New Synthetic Textile Fibers[1]

By Herbert R. Mauersberger[2]

IT IS AGAIN MY privilege to report on the subject of "Progress in New Synthetic Textile Fibers." My previous report made on October 17, 1940, has been reproduced in the Appendix of the 1941 Annual Report of the Smithsonian Institution, showing that our Government takes cognizance of our activities in identification, nomenclature, and technology of our new textile fibers and materials. It also appears in the A.S.T.M. Standards on Textile Materials.[3]

The information in the present paper is an addition to that given in the previous one. Much of this information is today quite inadequate, so fast has this industry grown and these developments taken place. My information has been obtained from sources believed to be authentic and reliable. Some of these developments are already well known and are only included for the record; others have taken place quietly and may have escaped notice or attention.

Some of them are gigantic and could be dealt with at great length, which is not permitted here, whereas others are still in the formative stage and data must be withheld due to the war. No matter what your own experience is with or what your opinion may be of these individual fibers, remember at all times that practically all these fibers, yarns, and materials are custom-made to meet any domestic technological demand that may arise. Their versatility of use and flexible properties have been of tremendous value in the war effort and will be after the war.

Important in War Effort

Even in your fondest dreams could you imagine that insect and mosquito screens could be woven actually better with a synthetic monofilament yarn than with copper wire? Again, just imagine for one second where we would be in this war if it had not been for nylon parachutes and shroud lines, high-tenacity rayon bomb chutes, "Bubblfil" life preservers, Vinyon screen printing cloths, nylon tooth brushes, rayon paint brushes, and "Velon" or plastic coated window screens?

These certainly are not laboratory or experimental ghosts or guinea pigs; they are absolute realities and accomplished facts! A fine tribute to American ingenuity and the product of arduous and persistent research by American chemists, chemical engineers and technologists.

Time and space limitations preclude the inclusion in this paper of many technical details, and only the most important and outstanding advances in new synthetic fibers can be given. Only those fibers that have gone beyond the experimental stage and are in actual production now or will be immediately after the war are dealt with.

Nothing new or of interest can be reported on nylon, fibroin, fibers from corn, chitin, ossein, lichenin, Iceland moss, alginates or agar-agar. There are, however, developments of great significance in the protein-base fibers such as casein and soybean, which have been developed to a considerable extent in the past three years. There has also been a rapid advance in the vinylite resin group and in the thermoplastic resin groups.

Thermoplastic Resins

When Dow Chemical Co. produced "Saran" in 1939 (mentioned only briefly in my 1940 paper), no one believed that it would have any significant possibilities in the textile industry. It has seen many new textile applications since then.

The raw materials for these monofilament yarns are a group of resins from unsymmetrical dichlorethylene, known as vinylidene chloride resins, made from petroleum and brine. Ethylene is made by cracking petroleum while chlorine comes from the electrolysis of brine. They are combined to form trichlorethane, which is converted with lime into the vinylidene chloride monomer. This product can be readily polymerized to form the long-linear-straight chain polymers. By careful selection of copolymers and control of the polymerization conditions, many different polymers can be formed. These resins range from a flexible, moderately soluble material, having a melting point of about 158 F. to a hard tough thermoplastic, having a softening point of 350 F. or more. The basic resin is odorless, tasteless, and a nontoxic powder.

One of the several methods of extrusion is the one of crystal orientation, which produces long continuous monofilaments, tapes, bands, and other shapes. The oriented form is produced by extrusion, subsequent plastic deformation as by stretching, and by heat treatment. The material may be heat treated after or during stretching to affect the desired degree of crystallization. It produces monofilament yarns of considerable toughness and tensile strength, abrasion resistance, and chemical resistance to water, acids, alkalies, and many organic solvents.

Little of textile interest was done with these yarns until Mr. Stedman of Firestone Tire and Rubber Co., Akron, Ohio, took up the development and gave the name "Velon" to these products and established the Velon Department. A unit for production was set up at the Worldbestos Plant in Paterson, N. J., where monofilament yarns are being made as fine as 0.007 in. in diameter running from 10,000 to 12,000 yd. to the pound. Experiments for the extrusion of *multifilament* yarns are under way and it is expected that yarns as fine as 100 denier can be produced eventually.

At first, flat continuous bands were made to imitate "rattan" in the seat covers of buses and subway cars, and next, shoetop fabrics were woven for evening and sport shoes, using the "Velon" threads as warp and cotton yarns for filling.

As soon as round, monofilament yarns of sufficient fine-

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[1] Presented at the March, 1943, meeting of Committee D-13 on Textile Materials.

[2] Technical Editor, *Rayon Textile Monthly*, New York, N. Y.

[3] Abstracted in A.S.T.M. Standards on Textile Materials, October, 1941, p. 351.

ness were produced, Mr. Stedman interested August Hafner, President of Hafner Associates, who is a well-known specialty and experimental weaving expert in this country, to work out the textile possibilities. Mr. Hafner could see the potentialities of these yarns at once, and suggested their use for handbag, trimming, and millinery fabrics of unusual color, design, and weave variations.

Then came the war with its restrictions on copper, steel aluminum, and metals in general. This brought about replacements of metals in making mosquito and fly screens. These fly screens are now made successfully with vinylidene chloride resin yarns in 16 × 16, 12 × 12, and even 20 × 21 mesh. Window screens made from this yarn are supposed to provide better vision due to their greater transparency. At present, it is restricted for civilian use and its application in dressgoods and wearing apparel will have to await the end of the war.

New Elastic Vinyon E

Late last year, the Vinyon Department of American Viscose Corp., in addition to Vinyon filament yarn explained in my earlier paper, offered a new vinylite resin yarn with considerable elastic properties known as "Vinyon E." It possesses many characteristics of rubber and opens an entirely new field of applications. For some purposes, it has been found superior to rubber, because it has exhibited better resistance to sunlight, tropical heat, and humidity and is not affected by body acids. At present it is restricted to military uses, where it replaces rubber. However, after the war we will see many textile applications such as elastic webbing, tapes, cords, girdles, brassieres, surgical stockings, suspenders and supporters, and many articles now made of sponge rubber.

Casein Fiber

The next remarkable development has been in casein fiber. The National Dairy Products Corp. has further developed and made remarkable progress with its trade-named product "Aralac." The company has now formed Aralac, Inc., an entirely new division of the National Dairy Products Corp., which has increased its production almost eight-fold since 1940.

The original 4000-lb. a day plant at Bristol, R. I., was moved in July, 1941, to Taftville, Conn., with an output of 15,000. lb. per day. The product, originally used by the felt-hat trade, was then investigated by textile manufacturers. The advent of the war with its WPB restrictions on civilian wool use boomed interest in "Aralac," so that in 1942 the plant capacity was doubled to 30,000 lb. per day. The felt usage being relatively stable, a much larger percentage of this fiber now goes to the textile trade.

Aralac is offered in finenesses corresponding approximately to 50's, 60's, and 70's wool grades and in staple lengths from 1/2 to 6 in. Specialty uses include stuffing for pillows, comforters and quilted goods, interlining for cool-weather garments, and protection for milady's hair, when it is given a permanent wave. The last mentioned is in the form of a highly crimped combed top, and is known under the trade name "Wavecrepe."

Casein, the basic raw material from which Aralac is made, is a by-product of the milk industry. National milk production is upward of 117 billion pounds of milk annually. About 50 per cent of this is skimmed for its cream. The skim milk thus formed yields over one billion pounds of casein a year or over three million pounds of casein a day, a pound of casein making roughly one pound of "Aralac" fiber.

Casein fiber, unlike nylon, Vinyon, and acetate rayon, is made by a wet spinning process, somewhat similar to viscose rayon. Even these two processes are similar only at one point: namely, the extrusion through a spinnerette into a coagulating bath. Before this point, the Aralac process is much simpler than viscose; afterward, it is many times more complicated. The casein is dispersed in water by means of an alkali; the dispersion is clarified, spun, coagulated, and the two treated to give the filaments flexibility and hot water resistance. The fiber is then washed, dried, cut to staple length and baled for shipment to textile mills.

The properties of Aralac are in some instances similar to those of wool and it is being used entirely in mixtures with wool, rayon, and cotton fibers. It is not affected by organic solvents. It is not thermoplastic below charring temperatures. It withstands sulfuric acid carbonization as well as wool. Its alkali resistance at higher temperatures is somewhat lower, so low temperatures and mild alkaline or neutral detergents are recommended for scouring and washing. Considerable research has been done on dyeing this fiber and the dyeing problem is now well in hand.

Uniformity has made rapid strides and is now well under control. Being an animal base, it burns with the same odor and bead formation as wool and silk. Its strength, both dry and wet, are the same as last reported, about 60 per cent and 20 per cent that of wool, respectively. Regain at 70 F. and 65 per cent relative humidity is 12.6 per cent. Commercial regain is established at 13 per cent.

The largest textile use of Aralac at present is in dressgoods, but it is expanding into other uses, where a resilient, lofty hand is desired. The hat trade absorbs large quantities and practically every man's felt hat in this country and Canada, which has been made within the past three years contains some Aralac fiber.

It looks as if this fiber will go far, especially under present war conditions and with pressing needs for fiber conservation, in the textile industry.

Soybean Fiber

Ford Motor Co. of Dearborn, Mich., has considerably enlarged the production of this staple fiber which was explained quite fully in my 1940 paper. The company has now given this staple fiber the trade name "Soylon" and I understand is offering it to the cotton and worsted spinning, weaving, and knitting trade in volume. Robert A. Boyer has been in charge of this development at Dearborn and reports that the new plant has now reached 5000 lb. a day or 1,825,000 lb. annually. All machinery and equipment were designed by Ford engineers and are supposed to incorporate the latest mass production principles and devices. The fiber has been improved in strength and other physical, chemical, and microscopical properties.

Peanut Protein Fiber

It appears that casein of animal origin and soybean of vegetable base points to the future use of other vegetable proteins for textile fiber manufacture. An instance is a textile staple fiber from peanut protein.

Reports indicate that Imperial Chemical Industries, Ltd., of Glasgow, Scotland, has done considerable research work and D. K. Baird of the above company brought a sample of peanut protein fiber and cloth (made of 50 parts peanut fiber and 50 parts wool) to this country in 1939.

I am informed by the New York office of Imperial Chemical Industries, Ltd., that this work is at present still in the experimental stage. There has been no commercial development of the fiber in England or in any other country, neither could they state when such commercial development is likely to be achieved.

The only public knowledge of this work is in U. S. patent No. 2,230,624 applied for on February 4, 1939, and granted on February 4, 1941, to Andrew McLean, Saltscoats (Scotland) and assigned to Imperial Chemical Industries, Ltd., England. There are seven claims.

From what I have seen in very small samples the fibers have an excellent appearance, are softer than wool and fine, and take dyes even better than wool. It might be stated also that the above company has produced satisfactory fiber from castor seed and edestin, a crystalline globulin found in many edible seeds, such as wheat, rye, maize, etc. This indicates that we may see more of these protein fibers after the war.

Plastic-Coated Textile Yarns

Another unusual development, which has gone forward quietly and is now assuming considerable proportions and importance in the war effort, is the coating of cotton, rayon, and fiberglass yarns with infinitely fine coatings of plastic solutions to give them added and almost unlimited strength, brightness or dullness, color, to make them completely waterproof and moisture resistant, flame retarding or self extinguishing, or to make them resistant to mild acids, perspiration, oil and grease, as desired. This may seem difficult of accomplishment, but is now a reality and has found many interesting and technical applications in the textile industry.

It is the invention of two Frenchmen, Roumazeilles and Girard, and was patented in France in 1925 and in United States in 1930. The American patent rights to the now-called "Plexon Process" were purchased by Freydberg Bros.-Strauss in 1938. The first "Plexon" yarns were introduced here in 1939 after making many improvements in the methods and machinery required. At first quite expensive, the speeding up of the process and finding suitable and practical plastic formulations resulted in price reductions, which now brings these yarns within reach of many new applications.

In 1942 the entire procedure was revamped again, both as to machine construction and speed of production, so that today these yarns are made five times as fast as on the original French machine, a tribute to American engineering practice and genius.

It is possible by this process to apply as few coatings as six or as many as twenty-four, depending on the ultimate use of the thread. It is possible, for instance, to make a plastic-coated yarn as fine as 0.008 in. in diameter and up to approximately 0.09 in. in diameter. The dimension of the uncoated yarn could be almost anything within this range. It is possible to get an absolutely round thread by using graduated round disks. It is also possible to obtain different shapes such as elliptical, triangular, or square threads by using dies shaped to these forms. The process also envisions the application of plastic coatings and impregnations to flat tapes, bands, cords, and even wires.

In addition to shaping the coating, the yarns can be made in various finishes. They can be made stiff or soft, or any graduation in between. They can be made transparent, translucent, or opaque, smooth or rough, by changing the plastic coating. Color ranges take in the entire scope of pigments available, the current color line consisting of more than 120 different shades. Such plastic-coated yarns can be made completely waterproof, moisture resistant, verminproof, weatherproof, rotproof, flameproof, as well as resistant to mild acids, perspiration, oil, grease, gasoline, and even to withstand extremes of temperatures as in tropical or arctic climates.

Such plastic-coated yarns can be and have been woven, knitted, braided, twisted, plaited, or crocheted into many types of sheer and dress materials, drapery, auto upholstery, slipcovers, curtains, handbags, and shoe fabrics. A notable contribution to the war effort was made by developing a special type of coated yarn as a complete substitute for steel and copper wire in the weaving of insect and fly screens. Through intensive research a "Plexon" wire yarn was perfected, which used noncritical materials both in the support (a cotton yarn) and in the chemical formulation of the coating. A stiff wire-like coated cotton yarn was introduced to the insect screen industry, woven on ordinary wire looms without many changeovers or adjustments. The resultant insect screen was tested by the National Bureau of Standards and found completely satisfactory. These screens will not rust, can withstand high tropical temperatures, and require no painting, lacquering, or brushing and are in actual use now.

While there are several other developments, most of these are in the formative or experimental stages and they may not bear fruit until sometime after the war. However, they bear watching. It may be pointed out here that America at this rate need never again experience a shortage of textile fibers and will have a greater diversification of fibers for every purpose, demand, or use after this war.

New Classification of Man-Made Fibers

Concurrent with these facts given in this and my previous paper and as a summary thereto, I wish to present a new classification for all man-made fibers, which, I believe, will aid in clarifying this picture, and serve to place the fibers in a logical grouping.

In the past few years, it has become more and more apparent that the word "synthetic" is not the best or an all-inclusive word for the fibers I have discussed, but has been used for lack of another or more suitable word or words. It has become very clear to me that we have now two distinct types or groups of man-made fibers.

One large group distinctly derives from natural sources such as wood pulp, cotton linters, cow's milk, soybeans, peanuts, and silicate glass. I would like to term these "Regenerated Natural Fibers." (See Fig. 1.) They are not really synthetic at all. The dictionary defines synthetic as "of or pertaining to synthesis" and again synthesis "is the art or process of making a compound by combining elementary ingredients."

Furthermore, I suggest that these regenerated natural

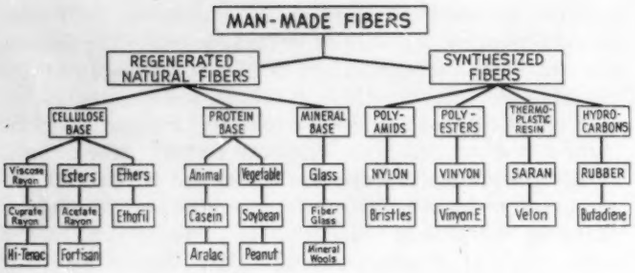

Fig. 1.

fibers be broken down into three distinct subdivisions according to the bases from which they originate: namely, (*a*) cellulosic bases, (*b*) protein bases, (*c*) mineral or inorganic bases.

Under the cellulosic bases we have first the viscose and cuprate, secondly, the cellulose esters, and thirdly, the cellulose ethers, all in filamentous *and* fibrous conditions.

Under the protein bases, we have first the animal protein fibers, namely, casein and Aralac, and, secondly, the vegetable protein fibers, where we have soybean and peanut fibers and others.

Under the mineral or inorganic bases, we have fiber glass (filament and staple) and the mineral wools, such as rock wool, glass wool, and slag wool.

None of these products or fibers are made by *true synthesis*, therefore, should not be termed synthetic fibers at all. I would like to recommend that we drop the word "synthetic" entirely for this group at least. I merely suggested the words "Regenerated Natural Fibers" because to regenerate means "to produce anew, to give new life, strength or vigor to, *to reproduce*." Is that not exactly what we do with these fibers? If someone can think of a more appropriate word, I would be delighted to substitute it for the above.

In the second main group of man-made fibers, belong all filaments and fibers produced by a combination of elementary or complex chemicals through synthesis, polymerization, copolymerization, heat treatments, stretch and setting operations, all of which are complicated, strictly chemical processes. Such materials as nylon, Vinyon, Saran, Velon, and synthetic rubber yarns belong to this group. I should like to suggest the words "Synthesized Fibers" for this group, instead of synthetic fibers, although the latter could be used here justifiably.

This second main group, I should like to subdivide for the present at least, first into the polyamids, which covers du Pont's nylon filaments, staple fiber and bristles; secondly into the polyesters, which covers "Vinyon" filament and "Vinyon E," the new elastic yarn; thirdly, into the thermoplastic resins, under which would come Saran, Velon, Permalon, and others; last and fourth, the hydrocarbons, which are to include all new synthetic rubber filaments, threads, and cords in full development now.

This classification separates the main products and subordinates none. I recommend it to you for consideration.

Use and Abuse of Gasoline at Philadelphia Meeting

A MOST INTERESTING lecture and demonstration on the "Use and Abuse of Gasoline, Kerosine, etc." featured the meeting sponsored by the A.S.T.M. Philadelphia District members at the Franklin Institute on April 22. Prof. Charles M. Allen of Worcester Polytechnic Institute, who on the previous day had been awarded the Elliott Cresson Medal by the Institute for his outstanding work in the field of hydraulics, and who for a great many years has given this lecture, had his audience of 175 interested and entertained throughout. He showed the fallacy of many conceptions on the explosive nature of gasoline and kerosine, and showed the necessary ratios of gasoline in air for explosion, also proving to his audience that these volatile liquids can be very safely handled . . . if one knows how. At one moment he was putting out a flame in gasoline or kerosine, and in the next moment created a "fiery furnace" which was, of course, under close control so that the presence of the fire company was not essential. Prior to the meeting a number of A.S.T.M. members and guests had dinner with Professor Allen, and at this informal function and also at the lecture were a number of former students and associates of the speaker at Worcester. Dinner arrangements were handled by E. J. Albert. The Philadelphia District chairman, F. G. Tatnall, who was responsible for the program and presided at the meeting, adding to the entertainment by some very interesting remarks on his early experience as salesman and demonstrator of certain fire-extinguishing chemicals.

Dr. Fieldner Speaks at Chicago Meeting

PAST-PRESIDENT A. C. Fieldner, Chief, Fuels and Explosives Service, U. S. Bureau of Mines, addressed the Western Society of Engineers in Chicago on April 22 on the subject, "Recent Developments in Fuels Supply and Demand." An invitation had been extended by the Western Society to A.S.T.M. members and committee people in the Chicago area to be present and notices were sent in advance of the meeting. Dr. Fieldner reviewed the field and brought those present up to date on the knowledge of fuel utilization. Many members will recall Dr. Fieldner's 1937 Presidential Address on "Fuels of Today and Tomorrow" and the widespread interest in this.

A.S.T.M. in WPB Orders

IN CONSERVATION Order M-297, effective May 1, 1943, producers or distillers are prohibited from burning as fuel or otherwise using coal tar except for distillation, or from making deliveries except to a distiller, when such coal tar contains one-half of one per cent or more of low-boiling tar acids, unless authorized by the War Production Board. The order further requires distillers to process all coal-tar oil, except oil produced or received prior to May 1, 1943, to a point where the low-boiling tar acid content is less than one per cent, unless authorized by the War Production Board. This restriction does not apply to coal tar oil containing, before processing, less than 1½ per cent of low-boiling tar acids.

In this order, methods of tests are prescribed in which the tar-acid content of *coal tar* is to be determined in accordance with A.S.T.M. Methods D 20 – 30 (Distillation of Tar Products Suitable for Road Treatment) and the total quantity of tar acids determined by A.S.T.M. Methods D 453 – 41 (Tar Acids in Creosote and Creosote Coal Tar Solutions).

For *coal tar oil*, the sample is distilled in accordance with Methods D 246 (Distillation of Creosote), with Methods D 453 used for determining quantity of tar acids.

A Method of Interpolation

By Lawford H. Fry[1]

THE METHOD of interpolation described was developed to smooth out a series of observations comparing diamond pyramid hardness and Rockwell C hardness numbers. It can also be used to construct a cubic curve to pass through four given points. The computation is much simplified if the four points are on ordinates equally spaced along the axis of the abscissas, as the points *A*, *B*, *C*, and *D* in Fig. 1.

The equations given below serve to determine four points spaced at equal intervals between each pair of known points, and do this without developing the equation to the curve. The points are more easily computed by starting with the fact that in the cubic curve, chosen to represent them, equally spaced increments have a common third difference.

The method of developing the equations on this basis is derived from Table I which shows the structure of a series of numbers built up from an initial number N_0, with a common third difference, c. The initial first and second differences are represented by a and b, respectively. In each line of the table the second difference is obtained by adding the third difference to the second difference in the preceding line; the first difference is obtained by adding the second difference to the preceding first difference, and the number is found by adding the first difference to the number in the preceding line.

From Table I it is evident that if we know four numbers equally spaced in the series it will be possible to set up three simultaneous equations from which values of a, b, and c can be found. It will then be possible to compute values for the numbers lying between those originally known.

TABLE I.—SERIES OF NUMBERS WITH CONSTANT THIRD DIFFERENCES.

Position in Series	Differences			Number	
	Third	Second	First	Designation	Composition
0	...	...	.....	N_0	N_0
1	...	...	a	N_1	$N_0 + a$
2	...	b	$a + b$	N_2	$N_0 + 2a + b$
3	c	$b + c$	$a + 2b + c$	N_3	$N_0 + 3a + 3b + c$
4	c	$b + 2c$	$a + 3b + 3c$	N_4	$N_0 + 4a + 6b + 4c$
5	c	$b + 3c$	$a + 4b + 6c$	N_5	$N_0 + 5a + 10b + 10c$
6	c	$b + 4c$	$a + 5b + 10c$	N_6	$N_0 + 6a + 15b + 20c$
7	c	$b + 5c$	$a + 6b + 15c$	N_7	$N_0 + 7a + 21b + 35c$
8	c	$b + 6c$	$a + 7b + 21c$	N_8	$N_0 + 8a + 28b + 56c$
9	c	$b + 7c$	$a + 8b + 28c$	N_9	$N_0 + 9a + 36b + 84c$
10	c	$b + 8c$	$a + 9b + 36c$	N_{10}	$N_0 + 10a + 45b + 120c$

General Expressions for Position n in Series:

Position of Number	n
Third Difference	c
Second Difference	$b + (n-2)c$
First Difference	$a + (n-1)b + \frac{n-(n-1)}{2}c$
Number	$N_0 + na + \frac{n-(n-1)}{1\times 2}b - \frac{n(n-1)(n-2)}{1\times 2\times 3}c$

In each position the second difference is the third difference added to the second difference in the preceding position, the first difference is the second difference added to the first difference in the preceding position, and the number is the first difference added to the number in the preceding position.

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It is usually convenient and sufficiently accurate to insert four values between each pair of known numbers. On this basis the four known numbers are taken as

$$\left.\begin{aligned} N_0 &= N_0 \\ N_5 &= N_0 + 5a + 10b + 10c \\ N_{10} &= N_0 + 10a + 45b + 120c \\ N_{15} &= N_0 + 15a + 105b + 455c \end{aligned}\right\} \quad \ldots\ldots(1)$$

If

$$\begin{aligned} D_5 &= N_5 - N_0 \\ D_{10} &= N_{10} - N_0 \\ D_{15} &= N_{15} - N_0 \end{aligned}$$

it is readily found that

$$\left.\begin{aligned} a &= 0.504{\cdot}D_5 - 0.224{\cdot}D_{10} + 0.048D_{15} \\ b &= -0.176{\cdot}D_5 + 0.136{\cdot}D_{10} - 0.032D_{15} \\ c &= 0.024{\cdot}D_5 - 0.024{\cdot}D_{10} + 0.008D_{15} \end{aligned}\right\} \quad \ldots\ldots(2)$$

The known values for the curve in Fig. 1 are $N_0 = 10$, $N_5 = 30$, $N_{10} = 40$ and $N_{15} = 70$ from which it is found that

$D_5 = 20$ and from Eq. 2 $a = 6.24$
$D_{10} = 30$ $b = -1.36$
$D_{15} = 60$ $c = 0.24$

Values for intermediate points are computed as in Table II and from these the curve in Fig. 1 is plotted. Figure 2 shows two other curves each drawn through four fixed points.

Another application is illustrated in Table III. This represents the computation of diamond pyramid hardness corresponding to Rockwell C hardness numbers. The assumed known values are:

Rockwell C Number	Diamond Pyramid Hardness	Series Number
35	345	N_0
40	392	N_5
45	445	N_{10}
50	512	N_{15}

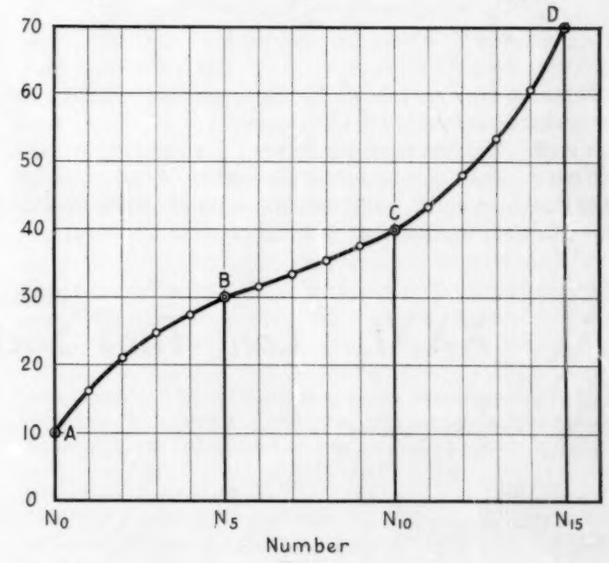

Fig. 1.

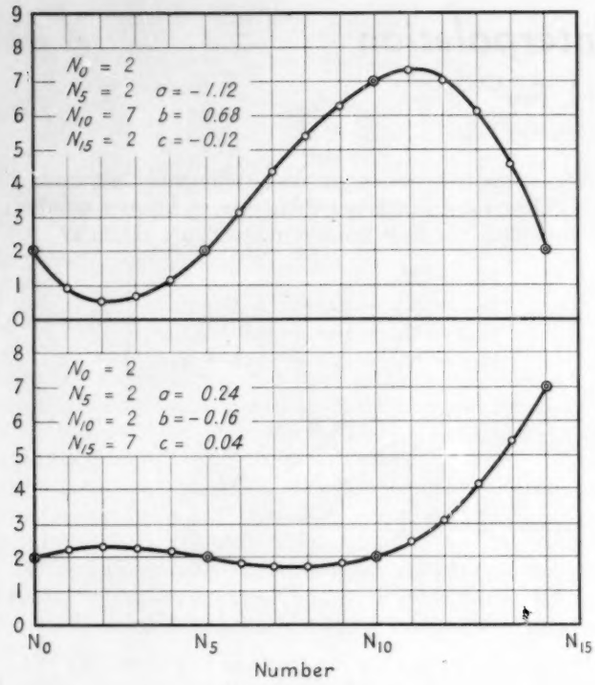

Fig. 2.

TABLE II.—VALUES OF CONSECUTIVE ORDINATES TO CUBIC CURVE TO PASS THROUGH POINTS, *A*, *B*, *C*, AND *D* IN FIG. 1.

Number in Series, *n*	Differences			Number
	Third	Second	First	
	c	*b*	*a*	N
0	....	....	....	10.00
1	....	....	6.24	16.24
2	....	−1.36	4.88	21.12
3	0.24	−1.12	3.76	24.88
4	"	−0.88	2.88	27.76
5	"	−0.64	2.24	30.00
6	"	−0.40	1.84	31.84
7	"	−0.16	1.68	33.52
8	"	0.08	1.76	35.28
9	"	0.32	2.08	37.36
10	"	0.56	2.64	40.00
11	"	0.80	3.44	43.44
12	"	1.04	4.48	47.92
13	"	1.28	5.76	53.68
14	"	1.52	7.28	60.96
15	"	1.76	9.04	70.00

From these values it is found that

$D_5 = 47$ and from Eq. 2 $a = 9.304$
$D_{10} = 100$ $b = -0.016$
$D_{15} = 167$ $c = 0.064$

The resultant values of the numbers in the series are computed as in Table III.

It will be evident from the form of the numbers in Table I that equations can be set up for curves of orders higher than the third and for any number of points to be inserted between each known pair of numbers.

TABLE III.—SMOOTHED DPH NUMBERS IN THE RANGE ROCKWELL C 35 = DPH 345 TO ROCKWELL C 50 = DPH 512, COMPUTED FROM VALUES IN COLUMN 3, TABLE IV.

Number in Series, *n*	Differences			Number
	Third	Second	First	
	c	*b*	*a*	N
0	....	....	....	345.000
1	....	....	9.304	354.304
2	....	−0.016	9.288	363.592
3	0.064	0.048	9.336	372.928
4	"	0.112	9.448	382.376
5	"	0.176	9.624	392.000
6	"	0.240	9.864	401.864
7	"	0.304	10.168	412.032
8	"	0.368	10.536	422.568
9	"	0.432	10.968	433.536
10	"	0.496	11.464	445.000
11	"	0.560	12.024	457.024
12	"	0.624	12.648	469.672
13	"	0.688	13.336	483.008
14	"	0.752	14.088	497.096
15	"	0.816	14.904	512.000

TABLE IV.—DETAILED INFORMATION FOR COMPUTATION OF SMOOTHED VALUES FOR DIAMOND POINT HARDNESS *VERSUS* ROCKWELL C NUMBERS.

NOTE.—The relation between the Rockwell values and the DPH numbers is approximately correct, but is not to be taken as an authoritative basis for conversion purposes.

Rockwell hardness group	20 to 35	35 to 50	50 to 65	20 to 65
1	*2*	*3**	*4*	*5*
Assumed Values of DPH Numbers:				
N_0	238	345	512	238
N_5	266	392	595	345
N_{10}	302	445	698	512
N_{15}	345	512	826	826
Differences:				
D_5	28	47	83	107
D_{10}	64	100	186	274
D_{15}	107	167	314	588
Values of				
a	4.912	9.304	15.240	20.766
b	0.352	−0.016	0.640	−0.384
c	−0.008	0.064	0.040	0.696

* Values in column 3 are used in computing Table III.

If the series of numbers actually represents a cubic curve the computed values for *a*, *b*, and *c* will apply through any desired range of numbers. In the majority of cases, as in the case of the diamond pyramid hardness *versus* Rockwell numbers, the numbers will not correspond exactly to a cubic curve, but over a short range the difference will be negligible. The full range of Rockwell numbers, 20 to 65, diamond pyramid hardness 238 to 826, can be split up into three subranges, 20 to 35, 35 to 50, and 50 to 65, and values of *a*, *b*, and *c* determined for each range. Such values are shown in Table IV. The last column of this table shows the values if the whole range is represented by a single cubic curve. This curve represents the measured values with a maximum deviation of about 1.5 per cent. When the range is split into three the curves do not deviate from the observed values by more than 0.5 per cent but have the advantage over the observed values of providing a smooth curve without any reversal of values in the first differences.

XXXI. Long-Time Society Committee Members

As a continuation of the series of articles in the ASTM BULLETIN comprising notes on the outstanding activities of long-time A.S.T.M. members, there are presented below outlines of the work of three additional members. In general, the men whose activities are described in this series have been affiliated with the Society for 25 years or more and have taken part in committee work for long periods of time. No definite sequence is being followed in these articles.

● M. F. SAYRE, Professor of Applied Mechanics, Union College, Schenectady, N. Y., is a graduate of Columbia University, 1907, with degree of Engineer of Mines; and Master of Arts degree, 1912. He was first employed in the Engineering Department, Copper Queen Mining Co., Bisbee, Ariz., 1907 to 1909, and was with the Arizona Eastern Railway, Globe, Ariz., from 1909 to 1910. For

H. S. Vassar M. F. Sayre R. B. Young

one year, 1910 to 1911, he taught and took graduate work at Columbia University. He was Superintendent of Construction, Croton Consolidated Iron Mines, Brewster, N. Y., for two years, beginning in 1911, and was with the Engineering Department, New Jersey Central Railroad, from 1913 to 1914. He has been associated with Union College, Schenectady, N. Y., since 1914. Since May, 1942, he has been Director of Engineering, Science, and Management War Training Program at Union College with an enrollment of over 1000 students.

Professor Sayre has been a member of the Society since 1917, and has been active on several committees including B-3 on Corrosion of Non-Ferrous Metals and Alloys, Subcommittees III on Spray Test and VI on Atmospheric Corrosion. He is chairman of the Section on Compression Testing of Committee E-1, and serves on the Section on Calibration of Testing Machines and Apparatus, and is also on the Technical Committee on Mechanical Testing. He is also a member of Committee D-18 on Soils for Engineering Purposes, serving on several subcommittees.

Professor Sayre is the author of various papers on mechanical and metallurgical subjects, and is the author of the section on springs in the 1938 Kent's Handbook.

He is a member of a number of other societies including American Welding Society, The American Society of Mechanical Engineers, American Society for Metals, American Institute of Mining and Metallurgical Engineers, Society for Promotion of Engineering Education.

● R. B. Young, Testing Engineer, Hydro-Electric Power Commission of Ontario, Toronto, Ont., Canada, was graduated from the University of Toronto in 1913 with the degree of B.A.Sc. He was awarded the professional degree of C.E. by the University of Toronto in 1919. Shortly after graduation, he joined the staff of the Hydro-Electric Power Commission as a Junior in their newly organized Testing and Research Department and has been in their employ ever since in positions of increasing scope and responsibility until he was appointed to his present position in 1936.

As well as the usual duties of the position, he has the immediate direction of the Structural, Chemical, Wire and Cable, and Concrete Laboratories and the Inspection Section which covers the shop and field inspection of all mechanical, electrical, and structural materials, and equipment.

He has been a member of A.S.T.M. since 1916 and has served on several technical committees including C-1 on Cement, secretary from 1922 to 1926; vice-chairman, 1926 to 1930, C-9 on Concrete and Concrete Aggregates (Subcommittees VI on Relation of Characteristics of Materials and Mixtures to Properties of Concrete, XVII on Conditions Affecting Durability of Concrete in Structures, and chairman of XVIII on Ready-Mixed Concrete, and the Advisory). He also is a member of the Joint Committee on Durability of Concrete (representing the A.C.I.)

He is a past-president of the American Concrete Institute, in which organization he has been most active, and he is also affiliated with the Engineering Institute of Canada, Canadian Engineering Standards Association, and is an Honorary Member, National Ready-Mixed Concrete Association.

He has specialized in the field of concrete technology and manufacture; and is the author of many papers and articles dealing with these subjects, several of which have appeared in A.S.T.M. *Proceedings*. In 1925 he won the Thomas Fitch Rowland Prize of the American Society of Civil Engineers, and ten years later the A.C. Wason Medal.

● Hervey S. Vassar, Laboratory Engineer, Public Service Electric and Gas Co., Maplewood, N. J., received his education at Pratt Institute, Brooklyn, graduating in 1903 in Applied Electricity. Upon graduation, Mr. Vassar became associated with the Public Service Electric and Gas Co., where he held various positions in engineering until 1911, and has been in his present position since 1911.

He has been a member of the Society since 1915. He was a member of the Executive Committee from 1932 to 1934, served as Vice-President, 1934–1935, and President, 1935–1936. His 1936 Presidential Address was a most interesting and thought-provoking one entitled "The Testing of Non-Materials," in which he stated that "there is within the organized workers in the field of physical science a potential force fully capable of being the leaven in the meal of society which can aid mightily in the development of a more rational approach to the problems of the day."

He has taken a very active part in various phases of A.S.T.M. work, chiefly involving materials pertaining to the electrical field. He has been a member of Committee D-9 on Electrical Insulating Materials since 1918, serving on Subcommittees IV on Liquid Insulation and V on Ceramic Products. He served as secretary of Committee D-9 from 1922 to 1926, and chairman from 1926 to 1930. His membership on Committee D-11 on Rubber Products dates from 1917. He is at present chairman of Subcommittee IV on Protection of Persons from Electric Shock. This group has handled a number of problems in connection with its widely used specifications on electrical gloves, and rubber matting. He took an active part in the organization of the Sectional Committee on Electrical Insulating Materials sponsored by A.S.T.M. under A.S.A. procedure and is one of the representatives of the electric light and power group. He is also a member of Committee B-2 on Non-Ferrous Metals and Alloys, Subcommittee II on Refined Lead, Tin, Antimony, and Bismuth. At the present, he is rendering notable service on Committee E-10 on Standards.

In addition to A.S.T.M., Mr. Vassar is a member of several other organizations including the American Association for the Advancement of Science, American Institute of Electrical Engineers, and The American Society of Mechanical Engineers.

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SOUTH BROAD ST.
PHILADELPHIA, PENNA.

Another Annual Meeting

THESE FEW NOTES are not intended for those who have participated in an A.S.T.M. annual meeting—for they have experienced the value and profit of spending a day or more at this meeting.

With so much of the Society's official business and activities concentrated in this five-day period, we would be remiss if we failed to urge every member if he possibly can to spend some time in Pittsburgh, June 28 to July 2. To those who have not attended a meeting and particularly to those who have not yet made plans, we submit the following.

An unexcelled opportunity is provided people in like fields of activity to discuss informally in hundreds of "corridor" and private conferences many of their perplexing materials problems. For the younger technical people, the meeting affords an opportunity to meet and fraternize with some of the pioneer leaders in their special field of work.

Every member should, whenever possible, attend the annual meeting sessions at which the Society's official business involving standards and committee reports are approved—for essentially the annual meeting is a "stockholders meeting" where actions are formally taken on the company's business.

This year many A.S.T.M. members may find it somewhat difficult because of pressure of work to get away for as long as they might have normally but the personal benefits might well be worth the extra effort.

This BULLETIN through the Provisional Program and news announcements outlines some of the high spots of the meeting.

Sharing

APPEARANCE OF the new publication, the 1943 Symposium on Radiography, surely one of the most valuable the Society has published, calls for something more than the usual phrase "well done." The committee in charge, Messrs. Thomassen, Norton, and Seemann, have expended considerable effort and with Dr. Lester, chairman of the standing Committee on Radiography, have produced an outstanding contribution.

In the broad sense, the symposium is a very tangible product of technical cooperation, that which makes A.S.T.M. and any other society function. The willingness of the authors of the extensive technical papers to prepare and present their data is a far cry from the old days when technical men were reluctant to share their achievements with others.

The publication of information and data on properties and tests of materials, a long-time function of this Society, continues apace. We are grateful to those who make possible these books which are such great aids to both producers and consumers of materials.

Just what particular incentive prompts the respective individual serving on an editorial or symposium committee or an authority to cooperate so closely, it would be difficult to say, but we appreciate the very helpful assistance and take pride in the spirit so evident which makes the functioning of the Society and the system of which it is a part possible.

1942 Proceedings

IN THE *Proceedings* of the 45th A.S.T.M. Annual Meeting, Volume 42, which 1217-page book was distributed to the members in early March, is considerable material that most members have not heretofore seen, even though they might have procured the complete set of material printed before the annual meeting. These items include a number of technical papers which it was not possible to get in type before presentation, although abstracts of some of them may have been made available, but in particular the very considerable amount of discussion which makes this volume a most valuable one, often providing valuable additional data on a particular problem covered in a paper, and also different viewpoints on the interpretation.

This volume of *Proceedings* includes under one cover all the committee reports and technical papers. Previous to 1939 the book was issued in two parts, one on reports, the second one on papers.

Included in the group of 1942 papers that are published for the first time are the following: Factors Influencing the Reflectivity of White Portland Cement Concretes—C. W. Muhlenbruch and E. H. Miller; The Influence of the Durability of Aggregate upon the Durability of the Resulting Concrete—H. H. Munger; and Powdered Aluminum as an Admixture to Concrete—Roy W. Carlson.

In addition to the interesting address of President G. E. F. Lundell on Chemical Requirements and Chemical Analysis, this volume includes the 1942 Edgar Marburg Lecture on Gasoline—Past, Present, and Future, by Graham Edgar.

There are two notable groups of papers and discussions—the 1942 Symposium on Radiography which with the addition of several other technical papers and other information is being issued in separate book form under the heading "1943 Symposium on Radiography." The second item is the round-table discussion on Solvent Action of Water Vapor at High Temperature and Pressure, with its outstanding contribution by Dr. George W. Morey on Solubility of Solids in Water Vapor.

This volume, although it carries a rather prosaic title—"*PROCEEDINGS*"—and is in the form of an ordinary

book, nevertheless is one of the outstanding assets of membership in the Society. The great wealth of authoritative data and discussion on a wide range of materials and subjects, plus details on all of the actions recommended by standing committees during the past year make the volume invaluable.

NOTE.—Extra copies of the *Proceedings* can be purchased by members at $6 each; the price for nonmembers is $9.

New Sustaining Members

WITH FIVE NEW sustaining members included, the total number of organizations represented in this class of members is 165. Within the past two years the list of sustaining members has grown very substantially, and it is interesting to note that a few of the sustaining members have not previously been active in the Society or committee work. This is true with some of the very recent additions to the list.

As has been indicated, this class of membership was set up by the Society to permit organizations to contribute to the support of A.S.T.M. work in a measure more commensurate with the value of the standardization and research work to the particular company. There are, of course, a very large number of companies who are affiliated with the Society, in many cases with several members, and in this way and through the support of committee activities they also are contributing immeasurably to advancement of science and technology in materials.

Sustaining members have the same privileges as so-called company members with respect to affiliation on committees, that is, they can designate more than one technically qualified individual to serve on diverse committees to which the organization may be elected. However, there is a distinct difference between the publications received by a company and a sustaining member. At no extra charge a complete Book of Standards is furnished sustaining members and an extra set of the Book of Standards can be obtained on request. Also furnished is a copy of every one of the A.S.T.M. publications, including many which are furnished to members only on purchase. Another advantage is the privilege of having the ASTM BULLETIN sent to a number of individuals in the company.

PEOPLES GAS LIGHT AND COKE CO., EDWARD F. POHLMANN, CHIEF TESTING ENGINEER, CHICAGO, ILL.

This is the first affiliation as a company with A.S.T.M., but some of the technical men and executives have been connected with A.S.T.M. for a number of years, notably Robert B. Harper, Vice-President, who has been a personal member since 1915 and has been active particularly in the work of Committee D-3 on Gaseous Fuels, where he serves as Chairman of Subcommittee III on Determination of Calorific Value of Gaseous Fuels, and serves on the Advisory Committee. He has been a member of Committee A-3 on Cast Iron for eleven years and is on the Chicago District Committee. Mr. Pohlmann, representative of the sustaining membership, is Chairman of Committee D-3's Subcommittee V, having served on Committee D-3 for a number of years. L. F. Lottier is also a personal member.

NATIONAL LEAD CO., ALEX. STEWART, DIRECTOR OF RESEARCH, BROOKLYN, N. Y.

This new membership is in addition to other affiliations maintained by the company, including a life membership dating from 1903. Thus the company is one of the oldest from the standpoint of affiliation with the Society. Dr. R. L. Hallett, Chief Chemist of the company, continues to represent the company membership, with Mr. Stewart serving as representative for the sustaining membership. Dr. Hallett has been very active in A.S.T.M. work and is a former member of the Executive Committee. A number of other technical people in the company are active in the Society. M. Rea Paul, now on WPB service in Washington has been Secretary of Committee D-1, and C. H. Rose is Assistant Secretary. George O. Hiers is a personal member of the Society, Secretary of the A.S.T.M. New York District Committee, and active in a number of metals groups. E. J. Sheppard has been a personal member of the company from St. Louis since 1921.

The company actively supports work in a number of groups in the non-ferrous fields, and its technical representatives render service on other committees, including E-4 on Metallography, and C-14 on Thermal Insulating Materials.

CALUMET REFINING CO., R. F. DUNCAN, MANAGER OF TECHNICAL RESEARCH, CHICAGO, ILL.

This organization, a leading company in the petroleum field, is chiefly concerned with the work in Committee D-2 on Petroleum Products and Lubricants, where Mr. Duncan is the representative. Maxwell B. Jester has been a personal member of the Society for a number of years.

MEYER ENGINEERING CO., JOHN H. ROMANN, CONSULTING ENGINEER, DETROIT, MICH.

The sustaining membership of this organization is its first official contact with the Society, although J. H. Romann of the company is also a personal member and has been active for many years on Committee A-1 on Steel, notably in the fields of high-temperature and subatmospheric temperature service of pipe and tubing.

MATAM CORPORATION, A. D. GLOWINSKI, VICE-PRESIDENT, LONG ISLAND CITY, N. Y.

The latest sustaining membership comes from a company concerned primarily with furnishing of ordnance materials for the Armed Services. This company, like many A.S.T.M. groups, has received recognition through "E" awards for outstanding service.

Corrosion Coordinating Committee

THE FIFTH ANNUAL meeting of the American Coordinating Committee on Corrosion was held April 10, 1943, in Pittsburgh coincident with a one-day symposium on corrosion problems sponsored by the Corrosion Division of the Electrochemical Society. R. B. Mears was elected Committee Chairman for 1943–44, F. L. LaQue was named Vice-Chairman, and G. H. Young, Secretary-Treasurer. Committee headquarters are located at the Mellon Institute in Pittsburgh.

The committee was organized five years ago to coordinate research activities in this extremely important field and is patterned after similar organizations abroad. As its first contribution, the Coordinating Committee undertook to survey existing corrosion investigations in this country. Information report forms were submitted to some 600 individuals and companies, through the executive offices of the member organizations of the committee. From the data thus accumulated the committee issued in 1940 a confidential Directory of Corrosion Investigators and a classified list of subjects, which was sent to all persons officially listed in the Directory. This Directory has since been expanded to include additional investigators and to broaden its subject classification. A new revision is planned for 1943.

In connection with this revised personnel directory the committee has requested that all persons actively engaged in corrosion researches who have not been contacted write to the Secretary, G. H. Young, 4400 Fifth Ave., Pittsburgh, Pa., for further details and application forms.

Painting to Prevent Deterioration; New Mixing Formulas Proposed

A RECENT STATEMENT from the WPB Conservation Division recommends application of protection measures against deterioration, particularly for steel products in use or in stock. To prevent wasteful deterioration of semicompleted structures on which work was prohibited under Limitation Order L-41, buildings, bridges, etc., application of a primer and one finish coat is suggested. On steam shovels, excavator trucks, and other construction equipment a fresh coating should be applied once a year, and for steel plates stored in industrial plants and tank arsenals a primer should be applied, but if not exposed to the weather a finish coat is not considered essential.

In connection with this statement were details of new formulas for red, white, and blue paints made up on the job which would save considerable amount of normal linseed oil requirements.

Our limited imports of castor nut, babassu nut, and oiticica oil from South America; stoppage of our imports of tung oil from China, coconut oil from the Philippines, and palm oil from Africa; and lend-lease exports of edible oils have all contributed to the over-all shortage of fats and oils. Since oils are to a large extent interchangeable, increasing demands made on our limited supply of linseed oil, produced from flax grown in the Middle West, called for conservation measures.

Prepared by the National Bureau of Standards, the new formulas provide for substantial savings of linseed oil with no detrimental effect to the paint. Reduction of linseed oil content merely increases the pigment volume ratio.

	Customary	Proposed
DRY RED LEAD—100 lb.		
Raw linseed oil	3 1/8 gal.	2 gal.
Turpentine or mineral spirits	3/8 gal.	3/4 gal.
Liquid paint drier	2 1/2 pt.	2 pt.
PASTE RED LEAD—100 lb.		
Raw linseed oil	2 gal.	1 1/2 gal.
Turpentine or mineral spirits	3/8 gal.	3/4 gal.
Liquid paint drier	2 1/2 pt.	2 pt.
DRY BLUE LEAD—100 lb.		
Raw linseed oil	3 1/2 gal.	2 3/4 gal.
Turpentine or mineral spirits	1/4 gal.	1 gal.
Liquid paint drier	2 pt.	2 pt.
PASTE BLUE LEAD—100 lb.		
Raw linseed oil	2 3/4 gal.	1 3/4 gal.
Turpentine or mineral spirits	1/4 gal.	1 gal.
Liquid paint drier	2 pt.	2 pt.
PASTE WHITE LEAD—100 lb. (suitable for tinting)		
First Coat		
Raw linseed oil	4 gal.	2 1/2 gal.
Turpentine or mineral spirits	2 1/4 gal.	2 1/2 gal.
Liquid paint drier	1 pt.	1 pt.
PASTE WHITE LEAD		
Second Coat		
Raw linseed oil	1 1/2 gal.	1 gal.
Turpentine or mineral spirits	1 3/4 gal.	2 gal.
Liquid paint drier	1 pt.	1 pt.
PASTE WHITE LEAD		
Third Coat		
Raw linseed oil	3 1/4 gal.	2 gal.
Turpentine or mineral spirits	1/4 gal.	7/8 gal.
Liquid paint drier	1 pt.	1 pt.

In recent years new fast-drying finishes containing alkyd and phenolic resins have been developed. The Armed Services made heavy demands for these finishes to be used in coating shells, trucks, tanks, airplanes and ships. Increased demand and limited supply of this type of finish necessitated allocation control of phenolic resins established under Conservation Order M-246, issued November 4, 1942, and Conservation Order M-254, issued October 26, 1942. Conservation Order M-139, allocating control of alkyd resins, was issued December 7, 1942.

Because of these allocation controls, synthetic resins for use in the production of metal primer paints are not available for civilian use. However, the older type of finish (linseed oil) is more than adequate for non-combat use.

Building Code Recommended by Fire Underwriters

A REVISED EDITION of a publication which has profoundly influenced the makeup of building regulations has recently been issued, namely, the 1943 version of The Building Code recommended by The National Board of Fire Underwriters. This latest code was prepared under the direction of a committee of the Board, by L. H. Provine, Head, Department of Architecture, University of Illinois, with the close cooperation of other authorities in this field. A statement by R. P. Miller, Chairman of A.S.T.M. Committee C-5 on Fire Tests of Material and Construction and former superintendent of Buildings, Borough of Manhattan, New York, who was the principal author of the previous code, indicates "that this latest revision has been well done. The consideration of all existing provisions and requirements has been thorough. Recognition of developments in the field of building construction, in research of new materials and methods, in the enactment of new legislation regulating the use and occupancy of buildings in the interest of public safety, and in the administration of the applicable laws has been given."

The first 285 pages of the over 400-page publication provide 18 chapters covering such items as administration, definitions, classification, general restrictions, fire-resisting features, etc.

Then in extensive appendices are data on a number of other important topics, such as fire-resistance ratings for forms of construction, standard fire test, inspected appliances, wind pressures, earthquakes, protection against termites, piers, wharves, etc. Appendix E is of particular interest to many members of the Society, since this includes an extensive list of important standard specifications for various materials entering into building construction, some 72 A.S.T.M. specifications and tests being listed by title and designation. This appendix states:

"Like the underwriters' standards they have been prepared after much study and research by committees of men technically well qualified to fix these standards. They may be accepted as representing the best practice; and materials conforming to them should be accepted as meeting the requirements of this code within the limitations and conditions inherent in the standards or fixed by the code."

Since it is among the purposes of the National Board of Fire Underwriters to encourage the introduction of improved and safe methods of building construction and to establish standards for construction of buildings, copies of this code are distributed on request where the material would be of service in connection with ordinance framing, education and building design purposes.

A.S.T.M. Report to Inter-Society Color Council

THE ACCOMPANYING report by the delegates of the Society to the Inter-Society Color Council will be of interest to many members. The Society is a member of the Council, represented by Messrs. Brode, Paul, and Scott as voting delegates, and Messrs. Ashcroft, Bartoe, Foss, Huber, Mapes, Parker, and Van Zile as nonvoting dele-

gates. These men really tie in closely the various technical committees in which they are active with the work of the council. It will be recalled that in 1941 the A.S.T.M. and the Color Council jointly sponsored a most interesting Symposium on Color held as one of the technical features of the Washington Spring Meeting.

REPORT OF A.S.T.M. DELEGATES TO THE I.S.C.C.

Subcommittees of the American Society for Testing Materials have, during the past year, been actively engaged in several specialized studies of interest to the Council and contemplate certain additional work.

Anticipating in the event of war the probable need of a means for measuring and specifying sheen of a surface, Subcommittee XVIII (Physical Properties) of D-1 prepared some time ago a standard method for the determination of gloss of paint finishes. Variations by the Armed Services in the method of measurement have developed and an attempt will shortly be made to relate these. In this connection the desirability of having a standard method of panel preparation was evident. A committee has therefore been appointed to study and prepare adequate recommendations.

Committee D-1 has approved appointment of a second committee to examine the suitability of different methods of measuring color differences numerically and to invite participation of Committee D-13 on Textile Materials in this study.

In order better to define the work of Group 8 on establishment of appearance qualities in terms of goniophotometric measurements, the title was revised and the study identified as covering the preparation of a standard description of the geometry of reflection and transmission measurements.

Growing interest in infrared reflectance due to war need of such information has led to the appointment of a man to survey the desirability of Committee D-1 sponsoring a standard method for determining infrared reflectance of protective and technical coatings, results of this survey to be reported at the coming June, 1943, meeting.

Certain groups within the field of textiles (D-13) have reported on practical utilization of the A.S.A. color standard as sponsored by the Council, in an effort to develop unified color classification in the design, styling, production, quality control, and sales.

In concluding this report, the writer has two suggestions to offer. First, that an attempt be made to identify any projects now being carried on by the Council that have any bearing on the war effort and that these be expedited with the greatest possible speed. Second, that much of the confusion that develops in discussions respecting color in the Council's several member bodies is due to lack of adequate definitions. If at an appropriate time the Council could review existing definitions of its societies and associations and then propose additions or revisions, much might be accomplished toward correlating nomenclatures in newly initiated color studies.

In a report to the Society it is your delegate's intention to recommend continued A.S.T.M. membership in the Council.

Respectfully submitted,

M. REA PAUL, *Chairman*,
A.S.T.M. Delegates

March 2, 1943

Rigid Adherence to Die Casting Specifications Urged

RECENT STATEMENTS by those concerned with die castings have stressed the necessity of rigid adherence to the impurity requirements for various types of die castings, in particular, those covered by A.S.T.M. Specifications B 86 (Zinc-Base Alloy Die Castings).

A statement from a group in A.S.T.M. Committee B-6 that is responsible for the Society's work in this field which over a period of years has developed important data on the properties and applications of various die castings follows in part:

"It is timely to post a clear warning to those less experienced die casters and users of die castings that the provisions of these specifications are based on clear-cut knowledge of the permissible limits of composition. Deviations from the specified impurity limits, especially in the case of lead and tin, even in amounts which seem insignificant to the layman, may prove to be disastrous. These specifications, if observed, will insure the quality on the basis of which the use of zinc die castings increased from a few thousand tons to 150,000 tons in ten years. If ignored, trouble is inevitable."

In this standard there are definite requirements on harmful impurities which in the case of zinc-base die casting alloys include lead and tin, maximum permissible tin content, 0.005 per cent; maximum lead, 0.007 per cent. These limits must be rigidly maintained to protect against intercrystalline oxidation which causes embrittlement, warpage, and other dimensional changes. Excerpt from a recent WPB statement follows:

"Maintenance of the specified purity requires the use of special high grade zinc and aluminum and copper and magnesium of adequate purity. For military use where zinc die castings are specified, these high grade metals are demanded by government specifications and are available; for nonmilitary uses, however, there is the same pressure in the die-casting field as elsewhere to find substitutes for scarce materials. This is apt to lead to the use of seriously inferior grades of metal.

"Although secondary aluminum can successfully be employed if it is free from objectionable impurities, experience has shown that only scrap which has been melted down, cast into pigs and analyzed can be safely used.

"Upon depletion of stocks of pure grade secondary aluminum, there was danger of the substitution of inferior grades to produce die castings of inferior quality. The importance of impurity-free zinc-base die castings was recognized, and in March, 1942, the ban against the use of primary aluminum, as imposed by Order M-1-i, was lifted. Virgin aluminum could once more be used for production of zinc-base die castings.

"Lead is a common substitute for zinc in die castings for certain specific purposes. It is not possible, however, to produce both zinc and lead die castings in the same plant without danger of contamination, as only one-eighth of an ounce of lead can contaminate 100 pounds of zinc.

"Playing a major role in today's production of war matériel, zinc-base die castings are used in shell, bomb and hand grenade fuses, gas mask fittings, and in carburetor and fuel pump parts for tanks, trucks, etc. The savings of man and machine hours as well as of critical materials weigh heavily in favor of this type of production. Were perfection of production assured, it is entirely possible that there would be a far greater demand for zinc-base die castings for a greater variety of applications."

In connection with the above statement the new Tentative Specifications for Special Quality Aluminum-Base Die Castings ES-29 will be of interest (see page 11).

Under a plan developed in the WPB Die-Casting Industry Advisory Committee through a technical subgroup headed by D. L. Colwell, die-casting plants which were adequately equipped to make spectrographic and X-ray tests of die castings might be certified to procurement agencies as producers of "special quality zinc and/or aluminum castings." Companies wishing such certification may contact Mr. Colwell, now Deputy Chief, Materials Branch, WPB Conservation Division.

A recommendation that A.S.T.M. take action to adopt B 86 as standard has been approved in Committee B-6 by an overwhelming affirmative vote. This will be reported at the A.S.T.M. annual meeting in June and declared effective early in September following letter ballot of the entire A.S.T.M. membership. Meanwhile, the tentative specifications are available in separate pamphlet form and appear in the 1942 Book of A.S.T.M. Standards.

WPB Conservation Division Reorganized

AN EXTENSIVE reorganization of the WPB Conservation Division became effective on April 16 after many weeks of planning on the part of the Director of the Division, Howard Coonley, and his associates. By this plan the three former branches—Specifications, Conservation and Substitution, and Simplification—are rearranged into two "operating" branches—*Materials* and *Products*. Harvey A. Anderson, formerly Chief of the Conservation and Substitution Branch, becomes Deputy Director of the Division. C. L. Warwick, Secretary-Treasurer of the Society, formerly Chief of the Specifications Branch, becomes Chief of the new Materials Branch, and R. B. Shepard, Chief of the former Simplification Branch, now heads the new Products Branch. Many people active in the materials fields continue among the personnel in the branches.

One of the basic reasons for the reorganization was a change in the nature of production problems which up to recent months forced the Conservation Division to concentrate its work in alleviating shortages in raw materials. Material shortages have been somewhat reduced due to end-product curtailment, and to increased production facilities. Consequently, the problem today is no longer dominated by materials alone, but equally by manpower, electric power, productive capacity, and transportation. This necessarily called for corresponding changes in the War Production Board organization.

To facilitate contacts between the Conservation Division, and other correlating agencies within the WPB, with the Armed Services and other agencies in the United States and allied countries, an inter-agency staff has been set up which is headed by C. R. Ince.

The liaison between the Division and other War Production Board agencies will be on three levels—Administrative, Correlative, and Operational. The Director's office will provide the first, the Inter-Agency Staff the second, and the Specialists in the two Branches, the third.

In essence, the responsibility of the staff of the Conservation Division is to make over-all surveys for the purpose of conserving critical materials, manpower, productive capacity, and transportation. These surveys are presented to the other Divisions of the War Production Board and the War Agencies in the form of recommendations. If these are adopted, the Conservation Division assists in implementing their provisions and promoting their effectiveness. This insures an equitable balance and distribution of conservation measures throughout industry.

Limitation Order on Carbon-Steel Plates

ON THE RECOMMENDATION of the Administrative Committee in charge of the National Emergency Steel Project with C. L. Warwick as Administrator, the War Production Board on March 22 issued its carbon-steel plate Schedule No. 8, to Limitation Order L 211. The basic recommendations were developed in the Technical Advisory Committee on Carbon-Steel Plates with leading technical authorities representing producing and consuming interests and the military services as members functioning under the chairmanship of O. U. Cook, Tennessee Coal, Iron and Railroad Co.

While the number of grades of steel listed in the accompanying tables would appear extensive, actually there has been very great simplification and the number of specifications involved is not large compared with the several hundred that were in current use, although many to a limited extent. The elimination of special and nonessential specifications should be of definite help in connection with production.

National emergency specifications for steel products have already been put into effect for concrete reinforcing steel (Schedule 1); steel wheels and tires (Schedule 2); barbed wire, wire fence (Schedule 3); structural steel shapes (Schedule 4); steel axles and forgings (Schedule 5); mechanical steel tubing (Schedule 6); and rails and track accessories (Schedule 7).

PART 3102—NATIONAL EMERGENCY SPECIFICATIONS FOR STEEL PRODUCTS
[Schedule 8 to Limitation Order L-211]

CARBON STEEL PLATES

§ 3102.9 *Schedule 8 to Limitation Order L-211*—(a) *Definitions.* (1) "Plates" means flat hot-rolled finished steel products in the following dimensions:

3/16" (0.1875") or thicker, over 48" wide.
1/4" (0.250") or thicker, over 6" wide.
7.65 lb. per sq. ft. or heavier, over 48" wide.
10.2 lb. per sq. ft. or heavier, over 6" wide.

(2) "Carbon steel" means any steel on which the maximum of the range is specified or guaranteed to be 1.65 per cent or less for manganese, 0.60 per cent or less for silicon, 0.60 per cent or less for copper, or on which the minimum of the range for copper is specified or guaranteed to be less than 0.40 per cent, or on which no minimum content for any other alloying element is specified or guaranteed, or known to have been added to obtain a desired alloying effect.

(3) "Government order" means an order placed

(i) By the Government of the United States or any department or agency thereof, or

(ii) By any other person covering material to be physically incorporated into material to be delivered to such government, department, or agency, or

(iii) By a warehouse which has been designated by such government, department, or agency as a source of supply for government orders, for delivery to a stock maintained for that purpose.

(b) *Restrictions on specifications*—(1) *Government orders.* No person shall produce or deliver on a government order any carbon steel plate which does not conform to a specification set forth in List 1 or List 2 of this schedule.

(2) *Other orders.* No person shall produce, or deliver on any order other than a government order, any carbon steel plate which does not conform to a specification set forth in List 1 of this schedule.

(c) *Acceptance of delivery.* No person shall accept delivery of carbon steel plates which he knows or has reason to believe were produced or delivered in violation of the provisions of paragraph (b).

(d) *Exceptions.* (1) The provisions of paragraphs (b) and (c) shall not apply to carbon steel plates:

(i) The production, fabrication, delivery, or acceptance of which is specifically excepted by the Director General for Operations, or

(ii) Which have been produced or fabricated prior to March 22, 1943, or which prior to such date have been processed in such manner and to such extent that processing to conform to such specifications would be impracticable.

(iii) Which are certified by the U. S. Army or Navy to the producer or supplier as being necessary to insure the military characteristics of the item for which such carbon steel plates are required.

(2) The provisions of paragraphs (b) and (c) shall not prevent:

(i) Waiver by the purchaser or procuring agency of any of the inspection or test requirements of the specifications prescribed in paragraph (b).

(ii) Delivery or acceptance of carbon steel plates which because of errors in manufacture do not conform to the requirements of paragraph (b), providing such requirements are waived by the purchaser or procuring agency.

(e) *Records.* Each person owning or possessing carbon steel plates excepted by the provisions of paragraph (d) shall retain records of such material available for inspection by duly authorized representatives of the War Production Board.

Issued this 22d day of March 1943.

CURTIS E. CALDER,
Director General for Operations.

SPECIFICATIONS PERMISSIBLE FOR GOVERNMENT ORDERS ONLY.

LIST 1.—SPECIFICATIONS PERMISSIBLE FOR GENERAL USE.

Schedule 8, L–211—Carbon Steel Plates

Tensile Strength	Specification Designation and Grade	Specification Title
SHIP HULLS		
55,000–65,000	ABS—1942, Section 39, Cold Flanging	Structural steel for hulls.
58,000–70,000	ABS—1942, Section 39, Structural	
STRUCTURAL		
45,000 Minimum	ASTM—A 78 – 40, Grade A	Low tensile strength carbon-steel plates of structural quality for welding.
48,000–58,000	ASTM—A 113 – 42, Cold Pressing	Structural steel for locomotives and cars.
48,000–58,000	AAR—M 116 – 42, Grade C	Steel, structural, shapes, plates, and bars.
50,000 Minimum	ASTM—A 78 – 40, Grade B	Low tensile strength carbon-steel plates of structural quality for welding.
50,000–65,000	ASTM—A 113 – 42, Cars	Structural steel for locomotives and cars.
50,000–62,000	AAR—M 116 – 42, Grade B	Steel, structural, shapes, plates, and bars.
55,000–65,000	ASTM—A 113 – 42, Locomotives	Structural steel for locomotives and cars.
55,000–65,000	ASTM—A 10 – 39	Mild steel plates.
60,000–72,000	ASTM—A 7 – 42	Steel for bridges and buildings.
60,000–72,000	AISC—1941, Section 3	Structural steel.
60,000–72,000	AREA—1941	Structural steel.
60,000–72,000	AASHO—M 94 – 39	Structural steel for bridges and buildings.
60,000–72,000	AAR—M 116 – 42, Grade A	Steel, structural, shapes, plates, and bars.
80,000–95,000	ASTM—A 94 – 39	Structural silicon steel.
80,000–95,000	AREA—1941	Structural silicon steel.
80,000–95,000	AASHO—M 95 – 39	Structural silicon steel.
FLANGE AND FIREBOX		
NON-SILICON		
45,000 Minimum	ASTM—A 89 – 39, Flange, Grade A	Low tensile strength carbon-steel plates of flange and firebox qualities.
45,000 Minimum	ASTM—A 89 – 39, Firebox, Grade A	
45,000 Minimum	ASME—S 2, 1940, Flange, Grade A	Low tensile strength carbon-steel plates of flange and firebox qualities.
45,000 Minimum	ASME—S 2, 1940, Firebox, Grade A	
50,000 Minimum	ASTM—A 89 – 39, Flange, Grade B	Low tensile strength carbon-steel plates of flange and firebox qualities.
50,000 Minimum	ASTM—A 89 – 39, Firebox, Grade B	
50,000 Minimum	ASME—S 2, 1940, Flange, Grade B	Low tensile strength carbon-steel plates of flange and firebox qualities.
50,000 Minimum	ASME—S 2, 1940, Firebox, Grade B	
48,000–53,000	AAR—M 115 – 38, Firebox, Grade B	Steel, boiler and fire-box for locomotives.
48,000–58,000	ASTM—A 30 – 42, Firebox, Grade B	Boiler and firebox steel for locomotives.
52,000–62,000	AAR—M 115 – 38, Firebox, Grade A	Steel, boiler and firebox for locomotives.
52,000–62,000	ASTM—A 30 – 42, Firebox, Grade A	Boiler and firebox steel for locomotives.
55,000–65,000	AAR—M 115 – 38, Flange	Steel, boiler and firebox, for locomotives.
55,000–65,000	ASTM—A 30 – 42, Flange	Boiler and firebox steel for locomotives.
55,000–65,000	ASTM—A 70 – 42, Flange	Carbon-steel plates for stationary boilers and other pressure vessels.
55,000–65,000	ASTM—A 70 – 42, Firebox	
55,000–65,000	ASME—S 1, 1940, Flange	Carbon-steel plates for stationary boilers and other pressure vessels.
55,000–65,000	ASME—S 1, 1940, Firebox	
SILICON TYPE		
55,000–65,000	ASTM—A 201 – 39, Flange, Grade A	Carbon-silicon-steel plates of ordinary tensile ranges for fusion-welded boilers and other pressure vessels.
55,000–65,000	ASTM—A 201 – 39, Firebox, Grade A	
55,000–65,000	ASME—S 42, 1940 Flange, Grade A	Carbon-silicon-steel plates of ordinary tensile ranges for fusion-welded boilers and other pressure vessels.
55,000–65,000	ASME—S 42, 1940 Firebox, Grade A	
60,000–70,000	ASTM—A 201 – 39, Flange, Grade B	Carbon-silicon-steel plates of ordinary tensile ranges for fusion-welded boilers and other pressure vessels.
60,000–70,000	ASTM—A 201 – 39, Firebox, Grade B	
60,000–70,000	ASME—S 42, 1940, Flange, Grade B	Carbon-silicon-steel plates of ordinary tensile ranges for fusion-welded boilers and other pressure vessels.
60,000–70,000	ASME—S 42, 1940, Firebox, Grade B	
65,000–77,000	ASTM—A 212 – 39, Flange, Grade A	High tensile strength carbon-silicon-steel plates for boilers and other pressure vessels (plates $4^1/_2$" and under in thickness).
65,000–77,000	ASTM—A 212 – 39, Firebox, Grade A	
65,000–77,000	ASME—S 55, 1940, Flange, Grade A	High tensile strength carbon-silicon-steel plates for boilers and other pressure vessels (plates $4^1/_2$" and under in thickness).
65,000–77,000	ASME—S 55, 1940, Firebox, Grade A	
70,000–82,000	ASTM—A 212 – 39, Flange, Grade B	High tensile strength carbon-silicon-steel plates for boilers and other pressure vessels (plates $4^1/_2$" and under in thickness).
70,000–82,000	ASTM—A 212 – 39, Firebox, Grade B	
70,000–82,000	ASME—S 55, 1940, Flange, Grade B	High tensile strength carbon-silicon-steel plates for boilers and other pressure vessels (plates $4^1/_2$" and under in thickness).
70,000–82,000	ASME—S 55, 1940, Firebox, Grade B	

LIST 2.—SPECIFICATIONS PERMISSIBLE FOR GOVERNMENT ORDERS ONLY.

Schedule 8, L–211—Carbon Steel Plates

Tensile Strength	Specification Designation & Grade	Specification Title
SHIP HULLS		
50,000 Minimum (cold flanging)	Navy 48S5, Grade F	Steel, plate, hull, structural, black (uncoated) and zinc-coated (galvanized).
55,000 Minimum (common)	Navy 48S5, Grade C	
55,000–65,000 (cold flanging)	Federal QQ-S-751, Grade C	Steel, structural (including steel for cold flanging) and steel, rivet: (for) ships other than naval vessels.
60,000 Minimum (medium)	Navy 48S5, Grade M	Steel, plate, hull, structural, black (uncoated) and zinc-coated (galvanized).
60,000 Minimum (welding quality)	Federal QQ-S-751, Grade A	Steel, structural (including steel for cold flanging) and steel, rivet: (for) ships other than naval vessels.
60,000 Minimum (not welding quality)	Federal QQ-S-751, Grade B	
Floor plate (ribbed)	Navy 47S18, Type A	Steel, plate, floor, rolled.
Floor plate (raised, diamond)	Navy 47S18, Type B	
STRUCTURAL		
48,000–58,000 (soft)	Army 57-114, Class A	Steel: structural (for) ordnance matériel.
48,000–58,000 (cold pressing)	Federal QQ-S-731, Class C	Steel: structural (for) cars.
48,000–58,000 (cold pressing, copper-bearing)	Federal QQ-S-731, Class D	
60,000 Maximum	Army 57-114-1, Class A	Steel, plates, shapes, sheets, strips and rectangular bars for welded structures.
50,000–65,000	Federal QQ-S-731, Class A	Steel: structural (for) cars.
50,000–65,000 (copper-bearing)	Federal QQ-S-731, Class B	
60,000–72,000 (medium)	Army 57-114, Class B	Steel: structural (for) ordnance matériel.
60,000–72,000	Federal QQ-S-741 (Note 3): Type I, Class a	Steel, structural (including welding and rivet) (for) bridges and buildings.
60,000–72,000 (copper-bearing)	Type I, Class b	
60,000–72,000 (welding quality)	Type II, Class a	
60,000–72,000 (welding quality copper-bearing)	Type II, Class b	
60,000–72,000	Navy 22Y	Specifications for structural steel welding as amended to permit surface refinishing.
80,000–95,000 (high-strength-silicon)	Army 45-114, Class D	Steel: structural (for) ordnance matériel.
BOILER, PRESSURE VESSEL AND GENERAL PURPOSE		
55,000 Minimum	Navy 48P2, Class b	Steel, plate, marine-boiler.
55,000–65,000	CG, MIN 51.2, Flange, Grade A	Marine boiler steel plate.
55,000–65,000	CG, MIN 51.2, Firebox, Grade A	
60,000 Minimum	Navy 48P2, Class a	Steel, plate, marine-boiler.
60,000–70,000	CG, MIN 51.2, Flange, Grade B	Marine boiler steel plate.
60,000–70,000	CG, MIN 51.2, Firebox, Grade B	
65,000–77,000	CG, MIN 51.2, Flange, Grade C	Marine boiler steel plate.
65,000–77,000	CG, MIN 51.2, Firebox, Grade C	
70,000–82,000	CG, MIN 51.2, Flange, Grade D	Marine boiler steel plate.
70,000–82,000	CG, MIN 51.2, Firebox, Grade D	
Commercial quality	Navy 48P2, Class c	Steel, plate, marine boiler.

List 1.–:

NOTE.—Carbon-steel plates ordered to chemical composition only and those ordered to no specified tensile or chemical, requirements such as "tank" plates, "soft" plates, perforated plates, floor plates, safety tread plates, and those having special surface preparation for special applications shall conform to the applicable requirements of the American Iron and Steel Institute Steel Products Manual, Section 6, revised October, 1941.

NOTE 2.—ABS = American Bureau of Shipping, Rules for Building and Classing Steel Vessels.
AAR = Association of American Railroads, Manual of Standard and Recommended Practice.
ASTM = American Society for Testing Materials, Standard Specifications.
AASHO = American Association of State Highway Officials, Standard Specifications for Highway Materials and Methods of Sampling and Testing.
AREA = American Railway Engineering Association, Spec. for Steel Railway Bridges.
AISC = American Institute of Steel Construction, Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
ASME = American Society of Mechanical Engineers, Materials Specification Code.

List 2.–: CG, MIN = U. S. Coast Guard, Marine Inspection and Navigation.

NOTE 3.—Federal Specification QQ-S-711a or Federal Specification QQ-S-721a may be used pending publication and distribution of Federal Specification QQ-S-741.

NOTE 4.—The applicable issue of any of the Specifications in List 2 above shall be the issue in effect on the date of the invitation to bid, or on the date of the purchase order or contract, or such subsequent issue acceptable to the manufacturer as the procuring agency may substitute in the contract.

EA – A 139a

Issued April 8, 1943
(Superseding Issue of August 18, 1942)

The following Emergency Alternate Provisions, when specified, may be used as alternates in A.S.T.M. Standard Specifications for Electric-Fusion-Welded Steel Pipe (Sizes 8 in. to but not Including 30 in.) (A 139 – 42) and affect only the requirements referred to:

Title and Section 1.—In order to provide for sizes of pipe down to and including 4 in., change "8 in." to read "4 in." both in the title and in the first sentence of Section 1.

Section 5 (a).—Change the first sentence to read as follows:

5. (*a*) Analyses of two pipes from each lot of 300 lengths or fraction thereof of each size under 8 in., from each lot of 200 lengths or fraction thereof of each size 8 to 20 in., and from each lot of 100 lengths or fraction thereof of each size over 20 in., may be made by the purchaser from the finished pipe.

Section 6 (a).—Omit from the table the present requirements for elongation and substitute the following:

Wall Thickness, in.	Elongation in 2 in., min., per cent	
	Grade A	Grade B
5/16 (0.3125) and over	35.00	30.00
9/32 (0.281)	33.25	28.50
1/4 (0.250)	31.50	27.00
7/32 (0.2187)	29.75	25.50
3/16 (0.1875)	28.00	24.00
5/32 (0.156)	26.25	22.50
1/8 (0.125)	24.50	21.00
3/32 (0.0937)	22.75	19.50
1/16 (0.0625)	21.00	18.00

Section 10 (a).—Change the first sentence to read as follows:

One longitudinal tension test, one transverse tension test, and, if required by the purchaser, one bend test shall be made on one length from each lot of 300 lengths or fraction thereof of each size under 8 in., and on one length from each lot of 200 lengths or fraction thereof of each size 8 to but not including 20 in., and on one length from each lot of 100 lengths or fraction thereof of each size 20 in. and over.

Section 12 (a).—Change to read as follows:

12. (*a*) *Weight.*—The weight of any length of pipe shall not vary more than 10 per cent over or 5 per cent under that specified when the wall thickness is 0.188 in. and less, nor more than 3.5 per cent under that specified when the wall thickness exceeds 0.188 in. The carload weight shall be not more than 1.75 per cent under the nominal weight.

Section 14.—Add the words "Except as specified in Paragraph (*c*)" at the beginning of the second sentence of Paragraph (*b*).

Add the following as a new Paragraph (*c*), relettering the present Paragraph (*c*) as (*d*):

(*c*) *Ends, Threaded Pipe for Oil Field Casing or Conductor Pipe.*—When threaded pipe is to be used for oil field casing or conductor pipe, all threads shall be in accordance with the requirements for casing threads in the Specifications for Casing, Drill Pipe and Tubing (A.P.I. No.: 5-A) of the American Petroleum Institute.

Section 17.—Designate this section as Paragraph (*a*) and add a new Paragraph (*b*) to read as follows:

(*b*) *Water Works Service.*—Pipe thicknesses should be selected, not only with respect to the stresses to which the pipe will be subjected, but also with respect to the degree of corrosiveness of the soil and of the water to be carried, with due regard to the probable required life of the pipe and the cost of replacement. In cases where the water or ground, or both, have been known to be corrosive, due consideration should be given to the protection of steel water pipe, particularly that with thin walls. It is recommended that if coatings are used they conform to the Standard Specifications for Coal-Tar Enamel Protective Coatings for Steel Water Pipe of Sizes of 4 1/2 in. Outside Diameter up to but not Including 30 in. (A.W.W.A. No.: 7A.6-1940) of the American Water Works Association.

EA – A 148a

Issued, April 27, 1943
(Superseding Issue of February 24, 1942.)

The following Emergency Alternate Provisions, when specified, may be used as an alternate in A.S.T.M. Standard Specifications for Alloy-Steel Castings for Structural Purposes (A 148 – 42) and affect only the requirements referred to:

Section 1.—Change the references to class B and class C to read as follows:

Class EB.—Castings of one grade, which may be normalized, or normalized and tempered or drawn (Note 2).

Class EC.—Castings of three grades, which may be liquid quenched and tempered or drawn (Note 3).

Table I.—Change to read as follows:

		Tensile Strength, min., psi.	Yield Point, min., psi.	Elongation in 2 in., min., per cent	Reduction of Area, min., per cent
Regular Grades					
Class A	Grade 1	75 000	40 000	24	35
	Grade 2	85 000	53 000	22	35
Emergency Grades					
Class EB	Grade 3	100 000	65 000	17	30
	Grade 4	105 000	85 000	15	30
Class EC	Grade 2	120 000	100 000	12	25
	Grade 3	150 000	125 000	10	20

NOTE.—The six grades listed above are considered applicable during the war emergency period. Two of the six grades are regular grades with no change in requirements, while the other four are emergency grades with modifications intended to expedite production.

EA – A 236a

Issued, May 8, 1943

This revised Emergency Alternate Provision applicable in the Standard Specifications for Carbon-Steel Forgings for Locomotives and Cars (A 236 – 42) extends the scope of Emergency Class H to cover locomotive and tender axles. The present paragraph which covers Emergency Classes H and I material is now in two paragraphs, that for Class H reading as follows:

Class H (quenched and tempered) for locomotive and tender axles, main and side rods, straps, crank pins, piston rods, and similar locomotive and car forgings.

EA – B 85a

Issued April 15, 1943
(Superseding Issue of April 6, 1942)

The following Emergency Alternate Provisions, when specified, may be used as an alternate in A.S.T.M. Standard Specifications for Aluminum-Base Alloy Die Castings (B 85 – 42) and affect only the requirements referred to:

Table I.—Add the following requirements as to chemical composition for alloys Nos. LXXIX-A and LXXIX-B as alternates for alloys Nos. VII-A and VII-B, respectively:

	Alloy No. LXXIX-A Casting Alloy for Goose Neck Machine	Alloy No. LXXIX-B Casting Alloy for Cold Chamber Machine
Copper, per cent	3 to 4	3 to 4
Silicon, per cent	4.5 to 9.5	4.5 to 9.5
Nickel, max., per cent	0.5	0.5
Iron, max., per cent	2.0	1.3
Zinc, max., per cent	1.0	0.6
Manganese, max., per cent	0.5	0.5
Magnesium, max., per cent	0.10	0.10
Other elements, max., per cent { each	0.15	0.15
Other elements, max., per cent { total	0.5	0.5
Aluminum	Remainder	Remainder

EA – D 532a

Issued, April 15, 1943
(Superseding Issue of April 6, 1942)

The following Emergency Alternate Provisions, when specified, may be used as alternates in A.S.T.M. Tentative Specifications for Rubber Sheath Compound for Electrical Insulated Cords and Cables (D 532 – 39 T) and affect only the requirements referred to:

Section 2.—Omit the last sentence, which reads as follows: "It shall be vulcanized in a metal mold."

Section 3.—Omit the present table of requirements and substitute the following requirements for physical tests of the vulcanized rubber sheath:

Tensile strength, min., psi	2500
Elongation at rupture, min., per cent	400
Set in 2-in. gage length, max., in.	0.25
Tensile strength after 48 hr. in oxygen pressure test, min., psi	2000

Section 6 (a).—Omit the phrase "with the exception of the tear test" from the beginning of the second sentence.

Section 6 (b).—Omit this paragraph which describes the tear test specimen.

Fig. 1.—Omit this figure which shows the test specimen for the tear test.

Section 8.—Omit this section which describes the tear test.

Additional Reference on Lubricating Oils Paper

At the suggestion of the authors of the interesting paper in the March ASTM Bulletin, page 25, on "Oxidation-Corrosion of Lubricating Oils" an additional reference is cited, namely, the paper by M. D. Baker, of the West Penn Power Co., on the subject, "Wanted—A New Turbine-Oil Test," appearing in *Power*, page 64 (314), May, 1941. In this paper Mr. Baker brings up the question of addition of used oil to new oil in order to prevent rusting.

Reagent Chemicals For Educational Laboratories

Educational laboratories are now permitted to purchase their full annual requirements of reagent chemicals in any quarter, under Preference Rating Order P-135, as amended, by the War Production Board. The order still assigns a preference rating of AA-2X to deliveries of reagent chemicals, except maintenance, repair and operating supplies, for all laboratories. However, laboratories other than educational are restricted each quarter, as formerly, to deliveries equal to 25 per cent of their purchases during their annual base period ended September 30, 1942.

The amended order is intended to permit educational laboratories to continue their practice of ordering their full annual requirements in one lot, usually in the spring, but their annual quota is not increased. The amount of reagent chemicals received by any one such institution is not large, the WPB Chemicals Division pointed out, and it appears economical in terms of transportation and manpower to permit the practice to continue.

About the Book of A.S.T.M. Standards

We note from the house organ of our printer that the 1942 Book of A.S.T.M. Standards is termed "what girls call a 'honey.'" Apparently 1536 hours of press time were required to get the forms off, there were 39,700,400 printed pages, and the job took 96,950 sheets of paper. The three Parts, it is indicated, contained 8,319,376 ems of type composition.

Material Substitutions and Supply List, No. 8

Giving a comprehensive picture of the current status of materials used in war and essential civilian production, Issue No. 8 of the Material Substitutions and Supply List was released on April 22 by the War Production Board. The list is designed to guide industry in the conservation of more critical materials through substitution of less critical and noncritical materials.

Ranked on the basis of necessity and availability, more than 500 materials are arranged in the following three groups:

GROUP I—Materials which are INSUFFICIENT in supply either for war demands alone or for war plus essential civilian demands.

GROUP II—Materials which are SUFFICIENT for war and essential civilian production.

GROUP III—Materials available in sufficient quantity for use as SUBSTITUTES for the more critical materials in Groups I and II.

Present and anticipated trends in production are reflected in the changed positions of several materials in the new listing. For instance, the mounting importance of the food situation has created a new grouping of Insecticides and Fungicides, some of which previously had been listed under Chemicals or Miscellaneous Products.

Softwood box lumbers and treated papers have been affected by the increased demands for overseas shipping containers. Secondary grades of lumber are now actually more critical than some primary grades. The treated papers—laminated asphalt, glassine, greaseproof and vegetable parchment—formerly listed in Group III, are becoming more critical and now appear in Group II.

Heavy hides have jumped from Group II to Group I. Hides are starred as they are among the most critical of the textiles and fibers in Group I.

Diversion to war production as well as increased food production have made the food oils relatively more critical. Fish and linseed oils, both previously appearing in Group III, are now in Group II.

Of the non-ferrous metals, bismuth, cadmium, and tin have become relatively more tight. In the ferrous group, the classifications remain about the same.

In urging greater use of the Material Substitutions and Supply List, Howard Coonley, Director of the Conservation Division, said, "American industry today is making progress on a three-way conservation program: (1) substituting more plentiful materials for the more critical variety, (2) improving design to save materials—up to 75 per cent of the original material requirements often has been conserved by this procedure—and (3) improving volume manufacturing methods. By the use of die cast and stamped parts to replace machined parts, manhours of labor as well as materials have been conserved.

"Pooling of ideas has contributed much to the over-all conservation effort. Industry is urged to continue sending new ideas for further conservation to the Conservation Division.

Copies of Material Substitutions and Supply List Issue No. 8 may be obtained upon written request to the WPB Conservation Division, Washington Gas Light Bldg., Washington, D. C.

Discussion on Durability of Concrete

LETTERS TO THE EDITOR

EDITOR'S NOTE.—The following two letters to the editor relate to the paper by Stanton Walker and Fred F. Bartel on "Effect of Size of Specimen in Studies of Durability of Concrete as Affected by Aggregates," published in the ASTM BULLETIN, No. 118, October, 1942, p. 37; and the discussion of this paper published in the ASTM BULLETIN, No. 121, March, 1943, p. 29.

Dear Sir:

I wish to present a few comments on the Authors' Closure in the March ASTM BULLETIN to my discussion of the paper on "Effect of Size of Specimen in Studies of Durability of Concrete as Affected by Aggregates," by Stanton Walker and Fred F. Bartel that was published in the October ASTM BULLETIN.

The authors have done little to clarify the points raised by my discussion. When I object to an unsupported conclusion on the durability of aggregates, they explain that the paper "presents only some exploratory tests on size of specimen;" when I object to an erroneous conclusion on size of specimen, they refer to the vast amount of data that they have on durability of aggregates. The new diagram (Fig. 1) leaves many unanswered questions and contradicts the principal conclusion of the paper.

The comments on Bartel's thesis suggest these conclusions:

> Readers of the BULLETIN are assumed to follow the activities of the National Sand and Gravel Association
>
> A thesis, that is not in evidence or open to discussion, takes precedence over anything in the paper
>
> Present and future readers of the BULLETIN are assumed to have access to Bartel's thesis
>
> If one is on the mailing list for "Technical Information Letter" of the N.S.G.A., he is thereafter estopped from criticizing statements made in the BULLETIN by their representatives.

The authors chide me for speculating on the uniformity of their tests, but they too speculate—on data that are in their hands. Table II gives values on the uniformity of the smallest beams, but we are told that "less uniformity would be expected in the small specimens," and that the larger beams have "not been investigated in detail." This is odd, since an intelligent office boy could work out the mean variations and probable errors in half a day.

We are told that "exploratory tests are generally limited in scope and rarely lead to final and definite conclusions;" also that the data were "inadequate for firm quantitative conclusions—none of which were drawn." Let us see how this holds for my criticisms of the following conclusion of the paper:

> "The partially saturated material (chert gravels) showed resistances comparable to those obtained from aggregates of known good service record."

My discussion pointed out that this (the most important conclusion of the paper) had no foundation on data presented. While the authors appear to disclaim the above conclusion, we find that after all it was "final and definite;" in fact before their disclaimer, they had emphatically restated it thus:

> "It is a fact that these partially saturated chert gravels showed resistances comparable to those obtained from aggregates of known good service record."

It is impossible to square the authors' "none of which were drawn" with the above "firm quantitative conclusions" on the durability of chert gravels.

Figure 1 is presented as supporting data on the question of thermal shock; however, the careless reader might readily assume that it was intended to support the above conclusions on chert gravels. The authors make no such claim. Figure 1 leaves many important questions unanswered. We would like to know the type and origin of the aggregates, size of beam, the "one or two" exceptions on the seventh curve, lot number of quartz gravel. We would like to know how the plotted points were arrived at. How close must values be to be "comparable to those" of known good service record? Why were "idealized" curves used?

We are wholly at sea with reference to most of these questions, but we get an accurate measure of what "idealized" means in one instance. For chert gravel 1364 (assuming 3 by $3^1/_2$-in. beams) the "stream wet" values were:

	Bulletin	Loss in Modulus of Elasticity, per cent		
		5 Cycles	10 Cycles	20 Cycles
Fig. 2	October	37	51	No test
Fig. 1	March	22	34	50
Ratio 2/1	...	1.68	1.50	...

In the case of this chert gravel the idealized curve gave a much more favorable picture than actually exists. The "idealized" curve is shown to 20 cycles, whereas 1364 was discontinued at 10 cycles; we have no assurance that this chert gravel would withstand 20 cycles of freezing and thawing. Figure 1 "idealized" this chert gravel to the extent of 68 per cent at 5 cycles, 50 per cent at 10 cycles, and completely falsified the actual test data at 20 cycles. Such extensive and unwarranted liberties with test data do not inspire confidence in the authors' other comparisons or conclusions. Departures of 68 and 50 per cent would throw almost any one of the aggregates from a given curve to a higher or a lower one.

One would like to know more of the "only one or two of those on the seventh curve" that did not have good service records. It is the exceptional unsound aggregate that must be weeded out, if concrete is to be durable. So far as any statements by the authors are concerned the "one or two" exceptions may include chert gravel 1364 that is under discussion. The other (1376) failed at the first freezing when tested "stream wet." Everything depends on just how much water was absorbed by the chert gravel before it was frozen, and on what were the one or two exceptions in the seventh curve of Fig. 1.

Let us examine Fig. 1 in order to determine how these "partially saturated chert gravels" compare with other "aggregates of known good service record." There is no absolute basis for comparison, and we do not know how many cycles correspond to good service records, but we can assume that an aggregate that lost 2 per cent at 20 cycles is better than one that lost 50 per cent; so that the number of cycles for a given loss is our measure of durability. The standing of the two chert gravels in a partially saturated state, as compared with 23 others of known good service record, when tested wet, may be shown thus:

Aggregate	Loss in Modulus of Elasticity, per cent	
	10 Cycles	20 Cycles
Chert 1376 (part saturated)	22	40
Chert 1364 (part saturated)	13	22
Average of 23 others (wet)	17	23

In view of the authors' statement, we used only 4 of the 6 aggregates on the seventh curve of Fig. 1, and assumed that in order to be "comparable to" the cherts, should give losses less than the average of the 23 others of known good service record. Chert gravel 1364 was a little better than the average of 23; chert gravel 1376 is distinctly poorer than the average of 23. The average loss of the two cherts is more than the average of the 23 others.

It is notable that river gravel 1551 of the paper does not appear on any curve in Fig. 1. If we plot its position (from Fig. 2 of the paper) we find that it falls about midway between the two lowest curves.

The principal conclusion (quoted above) that was first stated, then restated, then disclaimed, is not borne out by the tests in the paper.

We are told that "standard procedure was followed where applicable." The sodium sulfate test, freezing-and-thawing test, and percentage of deleterious materials in aggregates are standard procedure, yet we still know nothing of the results of such tests on the aggregates reported

in the paper. Standard procedure is no guarantee of scientific control. Inadequate data are shown by many expressions such as: "seems reasonable to suppose," "reasonably good," "makes it seem likely," "substantially the same."

In answer to my criticisms on lack of scientific control, the authors cite "selected" values. Two of my criticisms were met by references to a single test made on a quartz gravel, although "the quantity of material available was not sufficient to permit of making control beams for strength tests." By selecting as proof a single value from tests on "29 coarse aggregates," and particularly from an incomplete group (not identified on Fig. 1), one could establish almost any conclusions, however absurd.

The authors object to my characterizing the three gravels used in their tests as "freaks," yet two of them were cherts. Many investigations of chert aggregates have been reported during the past 20 yr.; all showed them to be inferior, particularly when used in concrete pavements. References to recent literature are given below.

Instead of answering the six questions raised at the beginning of my discussion, with reference to the characteristics of these gravels, the authors confined themselves to the statement: "these chert gravels meet all conventional specification limits, they fail to meet certain arbitrary specifications of recent origin." I do not know whether the A.S.T.M. standard for concrete aggregates is a "conventional specification." What they characterize as "arbitrary specifications" were drawn by users for the specific purpose of excluding aggregates that field experience had shown to be unsatisfactory. A number of highway departments have adopted specifications that rule out chert gravels and restrict chert in limestones to a small quantity, such as 3 to 5 per cent.

The authors admit that the third (river) gravel contained "considerable unsound material"; and that "the unsound material fell in no single mineral classification." Their "mineral composition" accounts for 90 per cent of the gravel. In spite of my direct questions, we can only guess at the *quantity* of this unsound material; we still know nothing of its *composition*. I maintain that a gravel that contains "considerable" material (probably more than 10 per cent) which is classified as unsound by two gravel experts is a "freak" in a research program on "durability of concrete as affected by aggregates."

The authors object to my term, but they show that all three of the gravels tested were "freaks," by stating that:

> "No useful purpose would have been served by selecting aggregates that would not contribute to breakdown. Such aggregates would have failed to have shown any significant effects—much less effect of size of specimen."

It seems to me that such a comparison would be invaluable in guiding the engineer in selecting aggregates that *would not contribute to breakdown*.

The authors express their appreciation of an opportunity to clarify and emphasize certain phases of the paper. The following statements need clarification:

> "The uniformity of the dynamic readings on specimens after freezing and thawing had been started were less uniform than in the case of the unfrozen specimens. However, the trends reported in the paper are clearly indicated."

In many other respects the authors' terminology is confused. We are told four different times that the paper merely "indicated trends." The title used the expressions, "effect of " and "as affected by." These are "firm" words; they are not compatible with "indicate" or "trend." After having made an assertion twice, in large type in the title, it is not permissible to attempt to nullify it by a directly opposite statement in small type at an inconspicuous place in another issue of the BULLETIN several months later.

In spite of their repeated claims on "trends," and that no "firm" conclusions were drawn, we saw how the authors appeared to repudiate their original conclusions, but instead they emphatically restated the most important one on the durability of chert gravels, which was not supported by anything in the paper, and is contradicted by the "idealized" curves in Fig. 1.

The following papers give information on behavior of chert as aggregate in concrete:

F. V. Reagel, "Chert Unfit for Coarse Aggregate in Concrete," *Engineering News-Record*, August 28, 1924, p. 332.

H. F. Kriege, "The Stability of Chert," *Rock Products*, April 27, 1929, p. 50.

H. F. Gonnerman, "Fine Aggregate in Concrete," Symposium on Mineral Aggregates, *Proceedings*, Am. Soc. Testing Mats., Vol. 29, Part II, p. 761 (1929).

F. R. McMillan and George W. Ward, "Influence of Coarse Aggregate on the Durability of Concrete," Symposium on Mineral Aggregates, *Proceedings*, Am. Soc. Testing Mats., Vol. 29, Part II, p. 820 (1929).

Report of Committee on Masonry, Am. Railway Engineering Assn., *Bulletin*, No. 323, p. 1157 (1930).

W. J. Emmons, "Effect of Soft Particles of Coarse Aggregate on Strength and Durability of Concrete," *Bulletin*, Nat. Sand and Gravel Assn., July, 1930, p. 13.

C. H. Scholer, "The Durability of Concrete," *Proceedings*, Highway Research Board, 1930, pp. 155, 156.

F. C. Lang, "Deleterious Substances in Concrete Aggregates," *Bulletin*, Nat. Sand and Gravel Assn., April, 1931, p. 19.

H. F. Gonnerman and G. W. Ward, "Durability Studies of Aggregates and Concrete," *Bulletin*, Nat. Sand and Gravel Assn., May, 1931, p. 17.

"Surface Pit Survey," *Research Abstracts*, Highway Research Board, October, 1931.

H. F. Gonnerman, "Researches on the Durability of Concrete," *Crushed Stone Journal*, May, 1931, p. 16.

H. F. Gonnerman, "Report of Research Laboratory," *Proceedings*, Portland Cement Assn., 1931, p. 180.

F. C. Lang and C. A. Hughes, "Accelerated Freezing and Thawing as a Quality Test for Concrete Aggregates," *Proceedings*, Am. Soc. Testing Mats., Vol. 31, Part II, p. 448 (1931).

H. F. Gonnerman, "Recent Researches on Concrete Aggregates by the Portland Cement Association," *Rock Products*, March 12, 1932, p. 40.

F. C. Lang, "Deleterious Substances," Report on Significance of Tests of Concrete and Concrete Aggregates, Am. Soc. Testing Mats., 1935, p. 97. (Issued as separate publication.)

Stanton Walker, "Soundness of Aggregates," Report on Significance of Tests of Concrete and Concrete Aggregates, Am. Soc. Testing Mats., 1935, p. 76. (Issued as separate publication.)

F. W. Capp, "Maintaining Concrete Structures," *Journal*, Am. Concrete Inst., Vol. 7, No. 5, May-June, 1936, p. 584.

D. G. Runner, "Petrography in Determining the Quality of Rocks," *Public Roads*, Highway Research Board, June, 1937, p. 72.

Curtis Cantrill and Louis Campbell, "Selection of Aggregates for Concrete Pavements Based on Service Records," *Proceedings*, Am. Soc. Testing Mats., Vol. 39, p. 937 (1939).

"Non-Durable Chert"—G. A. A., *Journal*, Am. Concrete Inst., Vol. 10, No. 3, January, 1939, p. 202.

S. C. Hollister, Civil Engineering Handbook, (edited by L. C. Urguhart) Chapter 7 on "Concrete," p. 539, McGraw-Hill Book Co., New York, N. Y. (1940).

H. S. Sweet, "Chert as a Deleterious Constituent in Indiana Aggregates," *Proceedings*, Highway Research Board, 1940, p. 599.

T. E. Stanton, "Influence of Cement and Aggregate on Concrete Expansion," *Engineering News-Record*, February 1, 1940, p. 60.

C. E. Wuerpel, "Detecting Unsound Chert in Aggregate," *Engineering News-Record*, May 9, 1940, p. 80.

C. E. Wuerpel, "The Soundness of Chert as Measured by Bulk Specific Gravity and Absorption," *Proceedings*, Am. Soc. Testing Mats., Vol. 40, p. 1021 (1940) (gives geological references).

F. R. McMillan, "Basic Research in the Effect of Alkalies, What the PCA Has Done and Is Now Doing," *Proceedings*, Conferences for Discussion of Problems Related to Alkalies in Cement and Their Effect on Aggregates and Concretes, Bureau of Reclamation, Denver, Colo., February, 1941, p. 107.

F. R. McMillan, "Alkali Cement and Parker Dam," *Engineering News-Record*, May 8, 1941, p. 727.

Report of Committee C-1 on Cement, *Proceedings*, Am. Soc. Testing Mats., Vol. 41, p. 225 (1941).

O. J. Porter, "California Experience with the Expansion of Concrete

Through Reaction Between Cement and Aggregate," *Journal*, Am. Concrete Inst., Vol. 13, No. 3, January, 1942, p. 221.

F. R. Hornibrook, Discussion of a paper by J. C. Pearson, "A Concrete Failure Attributed to Aggregate of Low Thermal Coefficient," *Journal*, Am. Concrete Inst., Vol. 13, No. 6, p. 36–3, June 1942.

F. V. Reagel and T. F. Willis, Discussion of a paper by J. C. Pearson on "A Concrete Failure Attributed to Aggregate of Low Thermal Coefficient," *Journal*, Am. Concrete Inst., Vol. 13, No. 6, p. 36–16, June, 1942.

"Concrete Manual," Bureau of Reclamation, 1936, p. 24; 1938, p. 36; 1941, p. 66; 1942, pp. 61, 91.

T. E. Stanton, "Expansion of Concrete Through Reaction Between Cement and Aggregate," *Transactions*, Am. Soc. Civil Engrs., 1942, p. 77.

F. C. Lang, "Deleterious Substances," Report on Significance of Tests of Concrete and Concrete Aggregates, *Second Edition*—1943, Am. Soc. Testing Mats., p. 139. (Issued as separate publication.)

H. F. Kriege, "Mineral Composition of Aggregates," Report on Significance of Tests of Concrete and Concrete Aggregates, *Second Edition*—1943, Am. Soc. Testing Mats., p. 155. (Issued as separate publication.)

Stanton Walker, "Soundness of Aggregates," Report on Significance of Tests of Concrete and Concrete Aggregates, *Second Edition*—1943, Am. Soc. Testing Mats., p. 118. (Issued as separate publication.)

M. O. Withey and K. F. Wendt, "Some Long Time Tests of Concrete," *Journal*, Am. Concrete Inst., Vol. 38, No. 3, February, 1943, p. 229.

The Missouri Highway Department began to observe poor results from chert in the aggregates used in their concrete roads as early as 1923. F. V. Reagel of that organization was probably the first to call widespread attention to the deficiencies of chert as aggregates. The title of his paper in *Engineering News-Record*, 1924, was "Chert Unfit for Coarse Aggregate in Concrete." This might readily be accepted as the refrain of most later students of the subject.

Duff A. Abrams, Consulting Engineer,
New York, N. Y.

• • • • •

Dear Sir:

I have read Prof. Abrams' letter of April 14 commenting further on the paper by Fred F. Bartel and myself, published in the October, 1942, BULLETIN and discussed in the March, 1943, BULLETIN. That letter departs from the original subject of the paper—effect of size of concrete test specimens on resistance to freezing and thawing—and opens up a discussion of the general subject of durability of concrete as affected by aggregates, with particular reference to chert gravels. Such a subject is too broad and too complex to cover adequately in an interchange of correspondence such as this.

As was pointed out in what was intended as the authors' closure, the original paper purported only to present some exploratory tests on effect of size of test specimens and made no pretense of attempting to answer the many difficult questions involved in the broad problems of aggregate durability. If some of the language used was so inept as to suggest the latter purpose, I express regret in behalf of myself and my coauthor, Lt. Fred F. Bartel of the U. S. Army Air Corps.

The thought that many chert gravels which are unsound when saturated offer, when partially saturated, resistances to freezing and thawing comparable to those obtained with aggregates of known good service record is not particularly new. Wray and Lichtefeld called attention to it in a paper before the Society.[1] Sweet [2] discussing chert from ledge rock says, "The degree of saturation of chert is probably the most important characteristic in determining its resistance to freezing and thawing. . . ." The Concrete Manual of the U. S. Bureau of Reclamation (Fourth Edition, 1942, pp. 91 and 92) says, "It has been established that the resistance of many cherts to disintegration by freezing and thawing varies with their degree of saturation. Cherts which disintegrate readily when saturated may be quite sound when dry. Moreover, when once dried they do not quickly or readily become equally saturated again." The authors' "closure," offers further supporting data.

[1] F. N. Wray and H. J. Lichtefeld, "The Influence of Test Methods on Moisture Absorption and Resistance of Coarse Aggregates to Freezing and Thawing," *Proceedings*, Am. Soc. Testing Mats., Vol. 40, p. 1007 (1940).

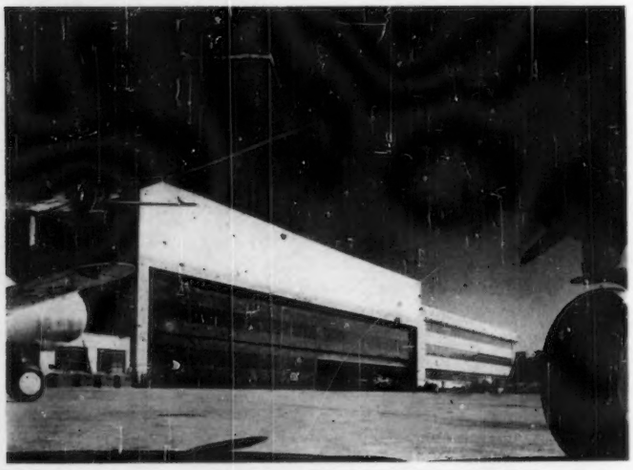
[2] "Chert as a Deleterious Constituent in Indiana Aggregates," by Harold S. Sweet, Proc. Highway Research Board, 20th Annual Meeting, 1940, p. 599. This publication deals with chert from limestone ledges; a later publication by the same author deals with chert from gravel; see Purdue University, Engineering Bulletin, Research Series 86.

Pertinent to discrepancies in test results to which attention was called, it should be pointed out that the specimens for Lot 1364, represented on Fig. 1 of the closure, were made in January, 1941; those for Fig. 2 of the original paper, made in a separate study of size of specimen, were molded in February, 1942. These earlier specimens (Fig. 1) were tested through 30 cycles of freezing and thawing. The modulus of elasticity at 56 days, just before freezing and thawing was started, was 5.75×10^6 psi. After 5, 10, 20, and 30 cycles of freezing and thawing, this value was reduced 29, 40, 55, and 62 per cent, respectively. At 87 days, when freezing and thawing was discontinued, the flexural strength was reduced 68 per cent below the 28-day value and 71 per cent below the 87-day value.

As to other questions of general interest concerning Fig. 1 that can be answered briefly, Lots 1238 and 1485 were "quartz" gravels; the beams were 3 by 3 1/2 by 14 in. To answer the questions with respect to type and origin of all the aggregates, etc., in an informative manner, would expand this discussion to a complete report on our durability studies which I am not prepared to write at the present time.

I hope that some of Prof. Abrams' questions concerning concrete and aggregates will be answered in future published reports from our Research Foundation at the University of Maryland. For some questions not touched on here, the reader is referred to the original paper and the authors' closure for such answers as are readily available.

Stanton Walker, Director of Engineering,
National Sand and Gravel Assn.,
Washington, D. C.



Another large war plant in which A.S.T.M. specifications have had a part—the Curtiss-Wright Plant at St. Louis, (Robertson) Mo. Photograph shows part of final assembly and subassembly building. Designed by Albert Kahn Associated Engineers & Architects, Inc.

Cast Pipe Fittings —WPB L-288

GRAY CAST IRON, malleable iron, and brass and bronze pipe fittings will be administered under WPB Limitation Order L-288, issued April 17, instead of under Schedule II of Limitation Order L-42. Schedule II of L-42 has been revoked and its provisions are incorporated without modification in L-288. The change follows the recent transfer of supervision of Schedule II from the Plumbing and Heating Division to the Shipbuilding Division. The transfer ends the situation in which parts of a single order were separately administered by different divisions. Operations of companies subject to the order are not affected.

This Program Is Subject to Change

Provisional Program

FORTY-SIXTH ANNUAL MEETING

of the

AMERICAN SOCIETY FOR TESTING MATERIALS

PITTSBURGH, PA. HOTEL WILLIAM PENN JUNE 28 TO JULY 2, 1943

	Morning	*Afternoon*	*Evening*
Monday June 28	Registration Committee Meetings	Committee Meetings	Committee Meetings
Tuesday, June 29	*1st* Soils	*2nd* Symposium on Soil Test Methods (*Continued*)	*3rd* Water *4th* Hardness Symposium
Wednesday, June 30	*5th* Petroleum Products, Asphalt *6th* Corrosion, Electrodeposited Coatings	*7th* Textiles, Soaps, Fire Tests, Glass, Thermal Insulating Materials, Fuels *8th* Non-Ferrous Metals *9th* 4:30 p.m. Marburg Lecture	*10th* General Session—Presidential Address; Award of Dudley Medal
Thursday, July 1	*11th* Iron, Steel *12th* Paint, Paper, Electrical Insulating Materials, Rubber, Plastics	*13th* Effect of Temperature, Fatigue *14th* Cementitious Materials	*15th* Concrete

Tuesday, June 29 9.30 a.m. First Session

Soils

Report of Committee D-18 on Soils for Engineering Purposes. C. A. Hogentogler, Chairman.

This progress report reviews briefly the activities of the committee during the year, including its sponsorship of the Symposium on Soil Test Methods being held at this annual meeting.

Symposium on Soil Test Methods

In preparation for this symposium a number of individuals have submitted descriptions of various test procedures for soils with which they are familiar. Following an outline by Mr. F. C. Lang as Chairman of the Symposium Committee on developments of soil testing methods, it is proposed to summarize these various test procedures. For this purpose the topic has been subdivided as follows:

Indication Tests. C. A. Hogentogler, Public Roads Administration.
Compaction Test. K. B. Woods, Purdue University.
Shear Test. E. J. Kilcawley, Rensselaer Polytechnic Institute.
Test Bituminous Mixtures. F. V. Reagel, Missouri State Highway Dept.
Test for Soil Cement Mixtures. M. D. Catton, Portland Cement Assn.

Following the presentation of the summary of a given group of tests it is proposed to call upon the individual authors to answer questions submitting in discussion of the individual test procedures.

(*Symposium continued in Second Session*)

Tuesday, June 29 2 p.m. Second Session

Symposium on Soil Test Methods (Continued)

Tuesday, June 29 8 p.m. Third Session

Held Simultaneously with Fourth Session

Water

Report of Committee D-19 on Water for Industrial Uses. Max Hecht, Chairman.

It is recommended that the methods for determining total carbon dioxide and calculation of the carbonate and bicarbonate ions in industrial waters, and for total orthophosphate and calculation of the respective orthophosphate ions in industrial waters, as revised, be adopted as standard. A survey is being made of the various methods of testing the corrosivity of water in its various states looking toward the formulation of a manual or guide consisting of descriptions of each test, its application to given conditions, and the results to be obtained by its use.

Report of Joint Research Committee on Boiler Feedwater Studies. C. H. Fellows, Chairman.

This progress report discusses primarily the research project on caustic embrittlement and briefly discusses other problems under consideration by the joint committee.

Laboratory and Field Methods for the Determination of Dissolved Oxygen. Robert C. Adams, U. S. Naval Engineering Experiment Station, Robert E. Barnett, U. S. Army, and Daniel E. Keller, Jr., U. S. Naval Engineering Experiment Station.

A method for determination of dissolved oxygen having a preci-

sion of 0.001 ppm. and an accuracy of 0.002 ppm. is described. Apparatus and procedure for a supplementary method by which unskilled operators can make such determinations with a precision of 0.02 ppm. also are presented. The laboratory evaluation of the precision and accuracy of both methods is given. All apparatus is illustrated and directions for preparation of reagents are summarized.

Applicability of the Schwartz-Gurney Method for Determining Dissolved Oxygen in Boiler Feedwater and Modification of the Method to Make It Especially Applicable in the Presence of Such Impurities as Are Encountered in Power Plants. R. C. Ulmer, J. M. Reynar and J. M. Decker, The Detroit Edison Co.

Since the Winkler Method for determining dissolved oxygen in water was developed, various modifications have been suggested to increase its accuracy and sensitivity, especially in the presence of impurities. It has generally been assumed that the regular Winkler Method gives results of sufficient accuracy for control purposes in the case of feedwater from plants using evaporated make up. In case greater accuracy is desired, the Schwartz-Gurney modification has been widely used. With either of these methods in this company's power plants, zero oxygen is often indicated for considerable periods of time, which is difficult to explain because of the occurrence of red rust in boilers and feedwater heating systems. Investigation has indicated that a sufficient amount of reducing agent is present, even when sodium sulfite is not used as an oxygen scavenger, to cause both methods to indicate zero oxygen when, actually, as much as 0.02 to 0.03 ppm. was present. This paper deals with a modification of the Schwartz-Gurney test that makes it applicable in the case of waters containing reducing agents.

Symposium on the Identification of Water-Formed Deposits, Scales, and Corrosion Products by Physico-chemical Methods

An appropriate and proper understanding of the cause and prevention of deposits, scales, and corrosion products may be secured when such materials are correctly identified. The statement of the results secured by chemical analysis furnishes a general picture of the amounts of each oxide present. The calculation of the items in the analysis to molecular form does not, in all cases, furnish the true nature of complex materials, that are formed under operating conditions. The tools of the research investigator, the polarizing microscope, the spectrograph, and the X-ray units, are now being applied to the problems that occur in the use of water in industry. These tools now are beginning to make available a fund of technical data. This permits the more proper identification of materials. The interpretations of these results allow a correct diagnosis of the undesirable conditions.

The program will be introduced by presentation of results secured from a Round-Robin Test of two samples of scales. There will be shown in successive steps the data found by macro- and microchemical analysis, by the microscope, by spectrographic and X-ray analysis. The identification of the materials and the interpretations of the analysis will be shown.

Introduction. H. C. Miller.

X-ray Diffraction Methods in the Study of Power Plant Deposits. C. E. Imhoff and L. A. Burkardt, Allis-Chalmers Mfg. Co.

Characteristics of X-ray patterns are enumerated and the meaning of these characteristics is discussed. The method of identification by X-ray diffraction is illustrated and the various kinds of power plant deposits known to be identified by this method are enumerated. X-ray and chemical analyses of twenty-two deposits are given to show the possibilities and limitations of the X-ray method. Various techniques are described and examples given to show how the X-ray diffraction method may be modified to give greater flexibility and sensitivity in the analysis of power plant deposits.

Diagnosis of Water Problems at Limbo Station. Everett P. Partridge, R. K. Scott and P. H. Morrison, Hall Laboratories, Inc.

Against the background of mythical Limbo Station, a variety of problems involving deposits from and corrosion by industrial waters are diagnosed. How identification of constituents of deposits by means of the microscope and X-ray diffraction supplements in some cases, and, in other cases, supplants chemical analysis is described. It is emphasized, however, that adequate knowledge of the conditions under which a deposit was formed and judgment based upon experience are necessary for the important step from identification of the constituents of a deposit to diagnosis of the actual problem to be solved.

The Interpretation of Analyses and Problems Encountered in Water Deposits. J. A. Holmes and A. O. Walker, National Aluminate Corp.

Ordinary chemical methods or macroanalysis of water deposits are not always satisfactory because they do not indicate the exact combination of the various constituents present; do not show the crystalline structure; and do not permit accurate analysis of very small samples. The presence of metallic particles, slime or corrosion organisms, or some plant process contamination may be recognized only by microscopic examination. Baked-on sludge and directly deposited scale may analyze the same chemically but appear widely different under the microscope. The physical form of a scale containing phosphate, silicate, or alumina compounds may show the temperatures at which it was formed and thus lend to a better story of actual conditions in a boiler. Microscopic observation will often show that scale is composed of layers of different composition due to changing water or conditions. Ordinary chemical analysis should generally precede other methods. If the components are few and simple, further checking is seldom necessary. If the analyses prove complex, the various components give clews for the microscopist to follow in identifying the deposit. Examples are given showing how macroanalysis may by itself be misleading unless more complete identification is obtained.

Tuesday, June 29 8 p.m. Fourth Session

Held Simultaneously with Third Session

Hardness Symposium

Report of Committe E-1 on Methods of Testing. W. H. Fulweiler, Chairman.

Reports completion of a new hardness conversion table for steels which presents data on the relationship among diamond pyramid hardness, Rockwell and superficial Rockwell hardness, and Brinell hardness. Completion of an important revision in kinematic viscosity thermometers to expedite production is also recorded. Reports work being undertaken on the use of Saybolt Furol viscosity at high temperatures for asphaltic materials and on further cooperative work on the standardization of measurement of viscosity in absolute units.

Briefly describes activities of technical committees on mechanical testing, consistency and plasticity, interpretation and presentation of data, conditioning and weathering, laboratory apparatus, and hydrogen ion concentrations.

Symposium on the Significance of the Hardness Test of Metals in Relation to Design

In 1940 a Symposium on Significance of the Tension Test of Metals in Relation to Design was held. The Committee dealing with such symposia considered it would be fitting to continue with a Symposium on Hardness.

This Symposium will contain four papers dealing with different viewpoints on this subject. The first paper will be in the form of an introduction by J. M. Lessells and will emphasize the value to the engineer of the indentation hardness test. The second paper by S. R. Williams will cover the various types of tests. A third paper by S. L. Hoyt will discuss the fundamentals of the hardness test. A fourth paper by J. O. Almen will discuss certain of the limitations of the hardness test.

The Value of the Indentation Hardness Test. J. M. Lessells, Massachusetts Institute of Technology.

This paper is a brief summary of the present status of the indentation hardness test with specific reference to the Brinell type of test. It is presented merely as an introduction to the other papers included in the Symposium.

The scope and limitations of the test are mentioned but the value of the test to the engineer as an aid in bri ging steels to their present state of development is emphasized.

Present Types of Hardness Tests. S. R. Williams, Amherst College.

In the upward progress of man some measure of the hardness of a body became necessary. The mineralogist wanted to classify his minerals, while the metallurgist needed some means whereby he could classify his metals as to their relative powers of penetration. This growth in the development of instruments for measuring hardness makes an interesting story in the annals of discovery and invention.

In the paper a rapid survey is made of the five main methods for measuring hardness. These are the scratch methods, indentation methods, rebound methods, portable instruments, and magnetic methods. The pioneer tester in each field is mentioned with one or two developments intervening between the pioneer and the modern method as they are now employed. Here and there it will be noted how the war is affecting this branch of testing materials.

Fundamentals of Hardness Testing. S. L. Hoyt, Battelle Memorial Institute.

Some Limitations of Our Present Hardness Testing Methods. J. O. Almen, General Motors Research Laboratories.

Prepared Discussion.

Wednesday, June 30 9.30 a.m. Fifth Session

Held Simultaneously with Sixth Session

Petroleum Products, Asphalt

Report of Committee D-2 on Petroleum Products and Lubricants. T. A. Boyd, Chairman.

A method of test for oil content of paraffin wax is recommended for publication as tentative. Proposed methods of test for saponification number of petroleum products by electrometric titration and for oxidation characteristics of steam turbine oils are included as information. Revised tentative methods of test for knock characteristics of motor fuels, and of aviation fuels are appended. Proposed revisions in three other tentative standards and two standard methods of test are covered in the report. The tentative methods of test for carbonizable substances in paraffin wax and in white mineral oil are recommended for adoption as standard.

Report of Sectional Committee Z11 on Petroleum Products and Lubricants. T. A. Boyd, Chairman.

A review is given of the new and revised methods accorded approval as American Standard during the year and to additional standards being recommended for submittal to the American Standards Association for approval as American Standard.

Report of Committee D-8 on Bituminous Waterproofing and Roofing Materials. J. M. Weiss, Chairman.

This progress report reviews briefly the activities of the committee during the year.

Report of Sectional Committee A37 on Road and Paving Materials. H. F. Clemmer, Chairman.

Records action taken during the year to refer eleven A.S.T.M. methods of test on road and paving materials to the American Standards Association for approval as American Standard.

Report of Committee D-4 on Road and Paving Materials. C. N. Forrest, Chairman.

This report includes for immediate adoption revisions in the standard test for penetration of bituminous materials. It is recommended that the tentative specifications for slow-setting emulsified asphalt for fine aggregate mixes be adopted as standard and that the remaining tentative standards under the jurisdiction of Committee D-4 be continued as tentative without revision.

Absolute Viscosity at the Ring-and-Ball Softening Temperature. W. F. Zybert and H. F. Mark, Brooklyn Polytechnic Institute.

This work was done under the auspices of a special research committee of Committee E-1 on Methods of Testing. It forms part of an investigation to determine whether the results of the A.S.T.M. Ring-and-Ball Test (E 28 – 39 T) can be expressed in absolute units, and is a preliminary step in establishing some of the flow fundamentals at the ring-and-ball temperature.

The viscosities of four materials of commerce over a broad range of temperatures have been explored by the parallel plate and ring-and-cylinder viscosimeters. The results indicate that at the ring-and-ball softening point the four materials examined (2 rosins and 2 asphalts) have the same viscosity, namely, $3 - 4 \times 10^3$ poises.

The age-old question of Newtonian *versus* Non-Newtonian flow and its bearing on this particular project are discussed.

A Method for Evaluating Performance in Service of Slow Curing Asphalts. Joseph Zapata, State Highway Commission of Wisconsin.

A report is made of studies conducted in the field to determine the nature of the changes undergone by asphalts of the slow-curing type under service conditions. The changes found are correlated to results obtained with a heat test of the type used in A.S.T.M. Tentative Method of Test for Residue of Specified Penetration (D 243 – 28 T). Systematic observations of mats in service are reported and correlated to laboratory tests. A practical application of the results which can be obtained with A.S.T.M. Method D 243 is illustrated in connection with the control of characteristics which govern performance in service.

Accelerated Weathering of Bituminous Materials—Effect of Operating Variables. Bruce Weetman, The Texas Company.

Accelerated weathering tests were made on five roofing asphalts from different crude oil sources in which the operating variables of the test were varied in order to determine their effect on the test results.

The data obtained show that the test temperature is of prime importance and must be carefully selected and rigidly controlled in order to obtain reproducible results. Amperage, refrigeration temperature, force of the water washing, and surface cleanliness of the aluminum panel do not effect the test results. The use of the electrometric procedure for determining panel failure is necessary for those asphalts which fail by the opening of fine cracks or "pinpoints."

It is concluded that a panel temperature of 140 F. should be used in this test in order to differentiate between the weathering qualities of different asphalts in the shortest practical time.

A Method for the Testing and Evaluation of Road Tars. E. O. Rhodes and H. E. Gillander, Koppers Co.

A method has been developed for testing road tars which makes it possible to predict in a period of 1 day the probable action of the material in service. The road tar is mixed with a standard testing sand, the mix packed into tubes, and a slow stream of air passed through the mix at 30 C. The course of weathering is followed by determinations of the stability and brittleness of the tar-sand mix and the percentage loss by evaporation of the tar.

Typical data obtained by this method are shown and discussed from the standpoint of road performance and present-day road tar specifications.

Wednesday, June 30 9.30 a.m. Sixth Session

Held Simultaneously with Fifth Session

Corrosion, Electrodeposited Coatings

Report of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys. Sam Tour, Chairman.

A method of total immersion testing of non-ferrous metals is recommended for publication as tentative. A résumé is given of the activities of the various subcommittees, and a report on the results of tests of 24 non-ferrous metals exposed to atmospheric corrosion for periods of one, three, six, and ten years, is appended.

Atmospheric Corrosion of Copper. A. W. Tracy, D. H. Thompson and John R. Freeman, Jr., The American Brass Co.

Data obtained from the exposure of several types of copper in the form of sheet and wire exposed to industrial, marine, and rural atmosphere over several periods up to 10 yr. are discussed. Data on sheet metal specimens exposed to sea water at half tide for three periods up to 2 yr. are also included.

The extent of corrosion of sheet metal specimens was determined by changes in weight and tensile properties; the extent of corrosion of wire specimens was determined by changes in tensile properties and electrical resistance.

The Total Immersion Corrosion Test. W. A. Wesley, The International Nickel Co., Inc.

The total immersion test is generally regarded as a type of corrosion test which it is not yet feasible to standardize due to lack of adequate means of control of the important variables. This belief is inconsistent with experience in routine and research testing of the corrosion of heavy metal alloys. Multiple measurements of corrosion rates of monel in acid solutions and steel in a salt solution were made by a total immersion procedure. The data furnish evidence of statistical control and the reproducibility of the results is considered adequate for both engineering and research purposes.

Report of Committee A-5 on Corrosion of Iron and Steel. C. D. Hocker, Chairman.

Reviews briefly work of the committee and presents tabulated inspection record of copper-bearing and noncopper-bearing corrugated black sheets exposed at Annapolis, Md., since October, 1916; also included is a detailed report containing results of atmospheric corrosion tests on wire and wire products after exposure for about 6 yr. at eleven test locations.

Report of Committee B-8 on Electrodeposited Metallic Coatings. E. M. Baker Chairman.

A recommended practice for preparation of low-carbon steel for plating is recommended for publication as tentative. Reference is made to the emergency specifications for electrodeposited coatings of lead on steel and to the tentative recommended practice for chromium plating of steel for engineering uses prepared by the committee; also presents a résumé of committee activities during the year.

Chromium Plate in Engineering Applications—Its Thickness and Finishing. T. G. Coyle, United Chromium, Inc.

Thickness values and finishing treatments for a number of important engineering uses of chromium plate are recommended and discussed. The information given complements the operating recommendations on plating methods outlined in the recently accepted A.S.T.M. Tentative Recommended Practice for Chromium Plating of Steel for Engineering Use (B 177 – 43 T). Plate thickness values generally found best for the more commonly used applications are included, and discussed specifically are practices to be recommended for many wear resistance requirements on parts such as tools, gages, molds, drawing dies, and plugs. Suggestions and recommendations covering preferred plating conditions for certain cases, and finishing treatments, such as grinding and lapping are also included. Some discussion is given to the function of the chromium plate in different applications, by way of generalizing for guidance in other applications not discussed in detail. Views on the practical limitations of setting up complete specifications for this general class of chromium plating are stated.

Properties of Plated Lead Coatings on Steel. Gustaf Soderberg, The Udylite Corp.

This paper is prepared to accompany the new Emergency Tentative Specifications for Electrodeposited Coatings of Lead on Steel which is being written by Committee B-8.

It is largely a literature review of outdoor and indoor exposures of lead-plated steel, solid lead alone, and solid lead in contact with steel and other metals; also solid lead immersed in sea water. To this has been added some unpublished exposure results obtained by the author and by Chrysler Corp.

The paper ends with a short summary of the physical properties of lead and lead-coated steel which have a bearing on the applications of the latter.

Factors Underlying Specifications for Electrodeposited Metallic Coatings. Edwin M. Baker, University of Michigan.

The writing of specifications for electroplated coatings to be used under new conditions of service should be facilitated by a study of A.S.T.M. specifications. These emphasize the importance of *minimum* coating thickness on significant surfaces, since coating thickness has been shown to correlate with weather exposure tests. The salt spray test is used on cathodic coatings as a test of continuity. The salt spray is not a proper test of anodic coatings, either for thickness or continuity. Reference is made to a proposed new specification for electrodeposited lead coatings, to a new Recommended Practice Specification for Chromium Plating, and a new proposed Recommended Practice Specification for the Preparation of Low-Carbon Steel for Electroplating.

Use and Misuse of the Salt Spray Test as Applied to Electrodeposited Metallic Finishes. C. H. Sample, Bell Telephone Laboratories, Inc.

With the conversion of industry to war production and the attendant increase in the use of specifications containing salt spray test requirements, the use of this test for judging the protective value of finishes, has been widely extended. It is the opinion of many that the test does not merit its current extensive use as the primary basis for acceptance or rejection, particularly in view of the lack of experimental evidence correlating salt spray results and the behavior of the many possible coating-basis metal combinations in the variety of environments to which they will be exposed.

Recognized proper uses as well as misapplications and known limitations of the test are discussed. Among other things, it is concluded that the test is frequently useful in evaluating the degree of porosity of metallic coatings of the electropositive type, but cannot be recommended as a quality test for electronegative coatings.

Wednesday, June 30 1.30 p.m. Seventh Session

Held Simultaneously with Eighth Session

Textiles, Soaps, Fire Tests, Glass, Thermal Insulating Materials, Fuels

Report of Committee D-13 on Textile Materials. H. J. Ball, Chairman.

Methods of testing and tolerances for spun, twisted, or braided products made from flax, hemp, ramie, or mixtures thereof, for rope (leaf and/or bast fibers), and a test for air permeability of textile fabrics are recommended for publication as tentative. New methods for identification of fibers in woven, knit, or braided textile fabrics are presented as tentative; also a procedure for commercial weight of rayon staple. Revisions of the following standards are also recommended for publication as tentative: Specifications for asbestos tape for electrical purposes, methods of testing woven textile fabrics, tire cord, spun rayon yarns and threads, and for continuous filament rayon yarns. The committee is recommending four tentative methods for adoption as standard; also that the tentative methods of testing asbestos tubular sleeving be revised and continued as tentative.

Report of Committee D-12 on Soaps and Other Detergents. H. P. Trevithick, Chairman.

This progress report reviews briefly the activities of the committee.

Paper Appended:

Cooperative Studies on a Laboratory Method for Evaluating Synthetic Detergents. J. B. Crowe, Procter & Gamble Co.

Report of Committee C-5 on Fire Tests of Materials and Construction. R. P. Miller, Chairman.

Included is a method of fire tests for window or door assemblies consisting of or containing elements of glass or other materials for the transmission of light, recommended for publication as tentative. The committee is recommending that the tentative specifications for fire-retardant properties of wood for scaffolding and shoring be withdrawn.

Tests of the Fire Resistance and Thermal Properties of Solid Concrete Slabs and Their Significance. Carl A. Menzel, Portland Cement Assn.

This paper deals with the performance of 16 solid concrete slabs when exposed on one face to standard fire temperatures. These slabs were tested vertically and simulated solid wall specimens 4, 6, and 8 in. thick. The slabs carried loads of 400 or 500 psi. during the exposure to fire. After cooling to room temperature, each slab was subjected to a second fire endurance test. The load-carrying ability after two exposures to fire was determined.

The tests developed significant information on the thermal properties of plastic concrete made with several widely different aggregates and on the effect of variations in the size of the highly siliceous aggregate and the period of air drying of the slabs before test. Relationships are established between slab thickness and the fire endurance period, for each type of aggregate. Other relationships give the approximate time required to obtain temperatures of 1000 F. (the critical temperature for reinforcing steel in flexural members) at various distances from the exposed face of the slab. The significance of the relationships presented are discussed in the light of data from various sources on the general effect of elevated temperatures on the yield strength and modulus of elasticity of open-hearth carbon steel.

Report of Committee C-14 on Glass and Glass Products. J. C. Hostetter, Chairman.

It is recommended that the following methods be revised and adopted as standard: Tentative methods of chemical analysis of glass sand and of soda-lime glass, hydrostatic pressure test, polariscopic examination, and thermal shock test on glass containers, and flexure testing of glass (determination of modulus of rupture).

Report of Committee C-16 on Thermal Insulating Materials. E. T. Cope, Chairman.

A progress report reviewing briefly the activities of the committee during the year.

Report of Committee D-3 on Gaseous Fuels. A. W. Gauger, Chairman.

This progress report summarizes the activities of the committee during the past year, including the studies now under way on the determination of calorific value, specific gravity and density of gaseous fuels, determination of impurities, and water vapor content of gaseous fuels.

Report of Committee D-5 on Coal and Coke. A. C. Fieldner, Chairman.

A new method of test for free-swelling index of coal is recommended for publication as tentative. Six methods under investigation for determination of plastic properties of coal, including expansion and expansion pressures developed during carbonization, are published as information with the report. Revisions are recommended in the method of sampling coals classed according to ash content, including a procedure for sampling large lump coal and run-of-mine coal and a procedure for sampling coal to determine total moisture.

The Gieseler Method for Measurement of the Plastic Characteristics of Coking Coals. Glenn C. Soth and Charles C. Russell, Koppers Co.

The problem of measuring the flow characteristics of coals is discussed and some methods which have been used for measurement are described. The modified Gieseler type plastometer is described completely and also the methods used to calibrate the instrument so that the results of tests may be expressed in absolute units, poises. Results of tests on typical coking coals are shown together with photographs of the retort residues. The limits of reproducibility of results for duplicate tests is shown and the problem of interpreting the results is discussed.

Wednesday, June 30 1.30 p.m. Eighth Session

Held Simultaneously with Seventh Session

Non-Ferrous Metals

Report of Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors. J. H. Foote, Chairman.

A brief progress report on the work of the committee during the year. Reports consideration being given to a test for ductility of coatings for incorporation in the emergency specifications for lead coated and lead-alloy coated copper wire for electrical purposes.

Lead-Alloy Coated Copper Wire for Electrical Conductors. C. J. Snyder, Anaconda Wire and Cable Co.

Data are presented to show the results obtained when three different lead-tin binary alloys were substituted for tin for coating copper wire. A new lead alloy, containing small amounts of cadmium, tin, and antimony, was developed for this application. This new alloy-coated wire more nearly approached tinned wire in physical properties than any other tried. The new alloy can be applied with standard equipment and a method of control to keep the coating uniform was worked out. Data show that substitution of this alloy saved 87 per cent of the former tin consumption.

Report of Committee B-5 on Copper and Copper Alloys, Cast and Wrought. C. H. Greenall, Chairman.

Revisions in the standard specifications for rolled copper-alloy bearing and expansion plates for bridge and other structural uses, phosphor bronze sheet and strip, and copper and copper-alloy seamless condenser tubes are presented for immediate adoption. It is recommended that the tentative specifications for bright annealed seamless copper tubing be revised and adopted as standard and that the tentative specifications for copper pipe, manganese bronze rods, and leaded red brass rods be adopted as standard without change. Reference is made to numerous emergency provisions accepted during the year.

Report of Committee B-4 on Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys. Dean Harvey, Chairman.

This report presents four new proposed tentative standards, as follows: Specifications for chromium-nickel-iron alloy castings for high-temperature service, tests for density of fine wire and ribbon for electronic devices, for effect of controlled atmospheres upon alloys in electric furnaces, and life test of electrical contact materials. Revisions are recommended in the tentative method of test for temper of strip and sheet metals for electronic devices and in the standard specifications for drawn or rolled alloy (80 per cent nickel, 20 per cent chromium, and 60 per cent nickel, 15 per cent chromium, balance iron) for electrical heating elements. There is appended to the report as information a proposed method of measurement of equivalent yield stress for thermostat metals.

Report of Committee B-6 on Die-Cast Metals and Alloys. J. R. Townsend, Chairman.

The tentative specifications for zinc-base alloy die castings are recommended for adoption as standard. Reference is made to the emergency specifications for special quality aluminum-base alloy die castings and emergency alternate provisions in specifications for aluminum-base and zinc-base alloy die castings, accepted by Committee E-10 on Standards during the year. Reviews progress of other committee activities and discusses revision of tentative specifications for magnesium-base alloy die castings to incorporate requirements for a new alloy.

Report of Committee B-7 on Light Metals and Alloys, Cast and Wrought. Sam Tour, Chairman.

Specifications for sheet and plate for use in welded pressure vessels are submitted for publication as tentative. Revisions are recommended in the tentative specifications for aluminum-base alloy sand castings, aluminum, aluminum-manganese alloy and aluminum magnesium-chromium alloy sheet and plate, aluminum-base alloy permanent mold castings, and aluminum-manganese alloy sheet and plate for use in welded pressure vessels. A résumé of the activities of the committee during the year is given.

Paper Appended:

A Comparison of the Performance of Anodic Coatings on Aluminum Alloys by Salt Spray Test and by Weather Exposure. Junius D. Edwards, Aluminum Company of America.

Experiments on Plastic Bending for Aluminum Alloy 17S-T. Joseph Marin, The Pennsylvania State College, and F. D. Cotterman, Crane Co.

This investigation deals with an experimental study of aluminum alloy 17S-T subjected to pure plastic bending. Plastic strains and deflections were measured for beams having different ratios of width to depth of specimen. To interpret these test results, theories for bending were developed based on approximations of the simple tension and compression diagrams. A comparison between theoretical and actual values shows that, for the variables considered, deflection-moment diagrams in plastic bending can be satisfactorily predicted by the theory developed. A new method also is given for defining the yield strength in bending.

Report of Committee B-2 on Non-Ferrous Metals and Alloys. E. E. Thum, Chairman.

A progress report reviewing briefly the activities of the committee during the year.

Conservation of Tin and Soft Solders. D. L. Colwell and W. C. Lang, Materials Branch, Conservation Division, War Production Board.

Information is presented on the necessity for reduction of the amount of tin used in soft solders as a measure of tin conservation. The use and properties of various low tin solders are discussed, including low tin lead, tin antimony lead, silver lead, silver antimony lead, tin bismuth lead, and tin cadmium lead compositions.

The paper is generally descriptive, dealing with current industry practice and investigations rather than with specific research problems. Recommendations are made concerning changes in soldering practice required for success in the use of alternate solder compositions. Several general property tables are presented and illustrations of successful substitute solder applications are pictured.

Short-Time Tests of Low-Tin Solders Listed in Recent Federal Specifications. J. A. Kies, W. F. Roeser, and S. K. Gutterman, National Bureau of Standards.

A study of soft solders complying in composition with Federal Specifications QQ-S-571a and QQ-M-151 has been made. Some of the factors on which the strength of a soldered lap joint depends are discussed. Results of spreading tests and tables of melting ranges and densities are given. Lap joints between strip or sheet specimens of brass, copper, black iron, galvanized iron, and tin plate were made. Tests of the joints, principally in shear, demonstrated that there was little difference between the strengths of similar joints made with the different solders on any one material.

Report of Committee E-3 on Chemical Analysis of Metals. G. E. F. Lundell, Chairman.

This report summarizes the completion during the year of a comprehensive revision and editorial review of all chemical methods for analysis of ferrous and non-ferrous metals. This included the preparation of a recommended practice on reagents and apparatus used in chemical analysis and new and revised methods for zinc die castings, nickel, magnesium, aluminum, electrical-heating alloys, brasses and bronzes, slab zinc, pig lead, and solder metal. These are being issued in a new edition of the A.S.T.M. Methods of Chemical Analysis of Metals. New work is under way on methods for determination of aluminum in alloy steels and on sulfur in steels by the combustion methods, and for small amounts of boron in steels and irons.

Report of Committee E-2 on Spectrographic Analysis. H. V Churchill, Chairman.

This progress report reviews briefly the activities of the committee during the year.

Wednesday, June 30 4.30 p.m. Ninth Session

Marburg Lecture

The purpose of the Edgar Marburg Lecture is to have described at the annual meetings of the Society, by leaders in their respective fields, outstanding developments in the promotion of knowledge of engineering materials. Established as a means of emphasizing the importance of the function of the Society of promoting knowledge of materials, the Lecture honors and perpetuates the memory of Edgar Marburg, first Secretary of the Society who placed its work on a firm foundation and through his development of the technical programs brought wide recognition to the Society as a forum for the discussion of properties and tests of engineering materials.

Eighteenth Edgar Marburg Lecture: "Wood as an Engineering Material." By L. J. Markwardt, Forrest Products Laboratory.

A summary of the more significant research accomplishments with wood as an engineering material, with respect to utilization both in its natural form, and in various modified forms through the use of glues and synthetic resins will be presented. Included will be an analysis of the relation of the structure to the properties, which is basic to the intelligent use of wood; and a review of advancements in seasoning technique, which permit large savings in drying time, and significantly also, marked reduction in drying defects and losses.

Wednesday, June 30 8.15 p.m. Tenth Session

General Session

Presidential Address; Award of Dudley Medal

Report of Committee E-10 on Standards. J. R. Townsend, Chairman.

The numerous new and revised tentative standards and tentative revisions of existing standards, as well as emergency standards and emergency alternate provisions accepted by Committee E-10 during the year are listed. Consideration is being given to the formation of several new committees in the Society covering standardization in the field of light hydrocarbons, powder metallurgy, adhesives, and porcelain enamels.

Report of Committee E-9 on Research. G. F. Jenks, Chairman.

Contains a brief discussion on research activities under way or sponsored by Society committees, and references to the work of the several research committees.

Annual Report of the Executive Committee. C. L. Warwick, Secretary-Treasurer.

A general report on Society activities and review of membership, publications, finances, and administrative matters relating to committee activities and inter-society relations.

Address

The Pittsburgh Committee is planning to have an outstanding speaker. Further announcement of this feature will be made.

Annual Presidential Address.

President Herbert J. Ball, Professor of Textile Engineering, Lowell Textile Institute.

Award of Charles B. Dudley Medal.

Recognition of Forty-year Members.

Introduction of Newly Elected Officers.

The terms of the new officers, under the provisions of the By-laws, begin at the close of the annual meeting.

Thursday, July 1 9.30 a.m. Eleventh Session

Held Simultaneously with Twelfth Session

Iron, Steel

Report of Committee A-7 on Malleable Iron Castings. E. K. Smith, Chairman.

A brief progress report reviewing the activities of the committee during the year, and recording the completion of emergency specifications for malleable iron flanges, pipe fittings, and valve parts, accepted by Committee E-10 on Standards.

Report of Committee A-3 on Cast Iron. J. W. Bolton, Chairman.

A progress report reviewing briefly the activities of the committee during the year.

Report of Committee A-6 on Magnetic Properties. Thomas Spooner, Chairman.

Revisions in the standard test for magnetic properties of iron and steel and in definitions of terms with units and symbols relating to magnetic testing are recommended for publication as tentative. Consideration is being given to a new method of testing feebly magnetic materials, also a-c. and d-c. permeability tests, and procedures for measuring core losses at frequencies up to 10,000 cycles.

The Measurement of a-c. and d-c. Permeability on 28-cm. Test Specimens. J. P. Barton and G. W. Smith, Carnegie-Illinois Steel Corp.

The A.S.T.M. Tentative Method of Test for Permeability and Core Loss of Flat-Rolled Magnetic Materials Using 28-cm. Specimen (A 257 – 42 T) provides a means for measuring a-c. permeability of flat-rolled magnetic materials, using a double lap joint core assembly. Investigation to date indicates that the same test frame and core assembly can likewise be used for making d-c. permeability measurements.

This paper reports typical measurements of a-c. and d-c. permeability on the same core assembly, using test specimens of materials having a large range in permeability and silicon content, and showing good agreement compatible with the effect of frequency on permeability when compared with the d-c. permeability.

Informal Report of Committee E-7 on Radiographic Testing. H. H. Lester, Chairman.

A résumé is given of the activities of the committee during the year together with information with respect to the extensive revision of the tentative methods of radiographic testing of metal castings which is under consideration.

Report of Committee E-4 on Metallography. L. L. Wyman, Chairman.

This progress report reviews briefly the activities of the committee during the year.

Report of Committee A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys. Jerome Strauss, Chairman.

Specifications for corrosion-resisting chromium steel clad and chromium-nickel steel clad sheet, strip, and plate for pressure vessel construction, and a recommended practice for the boiling nitric acid test are recommended for publication as tentative.

Report of Joint A.W.S.–A.S.T.M. Committee on Filler Metal. J. H. Deppler, Chairman.

Report of Committee A-1 on Steel. N. L. Mochel, Chairman.

This is essentially a report of progress with a record of the many

actions taken during the year and notes on some of the more salient features of the large number of emergency provisions. Only one action is requested—the adoption as standard of the tentative specifications for ring and disk forgings.

A Test for Measuring Drawability of Deep-Drawing Steels. Francis W. Boulger and F. B. Dahle, Battelle Memorial Institute.

The reasons for the failure of standard tests to evaluate the suitability of sheet metals for deep-drawing operations are discussed and an experimental testing method is proposed. Data from a simple drawing operation were used to detect differences in materials of obstensibly similar quality and the method was found to be accurate and reproducible. The test data indicate that temper rolling and increases in carbon and sulfur contents lower the cup-drawing ratings. Variations in manganese, copper and phosphorus, in the range investigated, were without effect on drawability. The test ratings of the steels agreed with available service figures.

The Strain Aging of Killed Low-Carbon Steel, with Particular Reference to the Effect of Titanium. George F. Comstock, The Titanium Alloy Mfg. Co.

The strain aging of heat-treated specimens cut from forged bars of killed low-carbon steel melted in a small induction furnace was studied by six methods, including comparison of the yield point, and noting the changes in impact value, hardness, and damping capacity on aging after straining. Results by the damping method were found to agree with those by the yield point method, but the impact and hardness methods did not classify different steels in the same way. Aluminum deoxidation of these steels was effective in preventing the kind of strain aging shown by impact tests, but its influence on the kind shown by yield point tests was slight. The effect of nitrogen was negligible in these killed steels. Titanium, if present to the extent of at least 4.5 times the carbon content, was effective in preventing strain aging as determined by all the methods. Such steel does not have a real yield point whether normalized, annealed, or strained and aged.

Structure and Creep Characteristics of Cast Carbon-Molybdenum Steel at 950 F. H. E. Montgomery and John Urban, The Lunkenheimer Co.

Cast carbon molybdenum steel has been heat-treated to obtain structures including both fine- and coarse-grained material. Specimens with the various structures and grain size were tested in creep to determine the effect on the creep rate. At 950 F. the type of carbide structure developed seems to outweigh the effect of grain size as such.

Thursday, July 1 9.30 a.m. Twelfth Session

Held Simultaneously with Eleventh Session

Paint, Paper, Electrical Insulating Materials, Rubber, Plastics

Report of Committee D-1 on Paint, Varnish, Lacquer, and Related Products. H. E. Smith, Chairman.

Three proposed tentative methods of test for traffic paint are included covering tests for conducting road service studies, for light sensitivity, and for dry-to-no-pick-up time. Five proposed tentative test methods for pigments include tests for barium sulfate, mica, magnesium silicate, aluminum silicate, and diatomaceous silica. A method for evaluating the degree of blistering of organic coatings on metal when subjected to immersion or other tests involving exposure to moisture or liquids is also recommended for publication as tentative. Revisions in the standard specifications for basic carbonate white lead are recommended for immediate adoption. Revisions are also recommended in the tentative test for phthalic anhydride content of alkyd resin solutions, and five tentative standards are recommended for adoption as standard.

Report of Committee D-17 on Naval Stores. V. E. Grotlisch, Chairman.

This brief progress report recommends adoption as standard of the tentative methods of sampling and grading rosin.

Report of Committee D-6 on Paper and Paper Products. L. S. Reid, Chairman.

Seven new proposed tentative methods are included, as follows: Test for degree of staining of paper by alkali, turpentine test for grease resistance of paper, tests for wire and felt sides and for surface wetability of paper, test for "kerosine number" as an absorptive quality of roofing and flooring felt by the vacuum method, tests for resistance of paper to passage of air, and for flammability of treated paper and paperboard. Revisions are recommended in the tentative method of qualitative examination of mineral filler and mineral coating of paper, and adoption as standard of four tentative methods. A résumé is given of the work before the committee including consideration of a number of new methods of test

Report of Committee D-9 on Electrical Insulating Materials. Myron Park Davis, Chairman.

New specifications for orange shellac (pure garnet and button lac) and specifications for low and medium voltage pin type insulators are recommended for publication as tentative. Proposed methods of test for gas content of insulating oil and for testing askarel are included as information. Statements on significance of tests covering pour point, free and corrosive sulfur, specific gravity, viscosity, flash point, color, neutralization number, dielectric strength, and mineral acids are also appended. Revisions are recommended in a number of the methods of test under the jurisdiction of the committee.

Report of Sectional Committee C 59 on Electrical Insulating Materials. H. L. Curtis, Chairman.

Reports on standards being recommended for submittal to American Standards Association for approval as American Standard.

Report of Committee D-11 on Rubber Products. J. H. Ingmanson, Chairman.

As a contribution to the war effort, the committee has prepared specifications for rubber and synthetic rubber compounds for general mechanical, aeronautical, and automotive use (except tires). Methods of testing compressed asbestos sheet packing and a test for low-temperature brittleness of rubber and rubber-like materials are also submitted for publication as tentative. It is proposed that the tentative method of testing sponge rubber products be revised and adopted as standard. A résumé is given of the activities of the committee dealing primarily with the effort to change from natural to synthetic rubber. New proposed tentative specifications for insulated wire and cable, polyvinyl insulating compound are included.

The Application of Flow Data in Design Problems. Irving L. Hopkins and Robert Burns, Bell Telephone Laboratories, Inc.

Part I of this paper deals with the relaxation, or decrease in stress of rubber-like materials when subjected to constant deformation, such as in gaskets. Part II discusses the use of flow data of rigid plastics in connection with design and assembly practices.

Report of Committee D-20 on Plastics. Robert Burns, Chairman.

Specifications for injection molding compound made from vinyl chloride-acetate resins, and tests for shear and flexural strength of plastics, measuring relative mobility of thermosetting molding powder (cup method), and resistance of plastics or plastic parts to extreme service conditions are recommended for publication as tentative. The report also lists ten specifications for various types of plastics prepared by the committee to aid the war effort which have been accepted by Committee E-10 on Standards. Nine tentative methods are recommended for adoption as standard. Specifications covering the following types of nonrigid plastics are being prepared: vinyl acetate, polyvinyl butyral, polyvinyl chloride, vinylidene chloride, and ethyl cellulose. A number of new methods under development by the subcommittees are covered as well as information with respect to two new subcommittees on analytical methods and research.

Impact Testing of Plastics—I. Energy Considerations. David Telfair and Howard K. Nason, Monsanto Chemical Co.

"Impact strength" values obtained by the standard Izod and Charpy test methods do not reliably indicate the behavior of a plastic part when subjected to impact stresses in service nor do they accurately rank different plastic materials with respect to their ability to resist fracture when exposed to such stresses. An analysis of the energy relationships in these tests accounts for some of the discrepancies, and a modified test, which measures the energy required to just initiate fracture in a test specimen, is proposed. The results obtained by this modified test, rank materials in order of their known shock-resisting qualities, and correlate well with service experience.

The Relation Between Repeated Blow Impact Tests and Fatigue Tests. William N. Findley, University of Illinois, and Otto E. Hintz, Radio Corporation of America.

The tests reported were undertaken to determine the effect of repeated-blow impact on cellulose acetate and to evaluate the effect of repeated impact in terms of fatigue properties of the material.

Results of repeated-blow impact tests resulting in failure were compared with results of fatigue tests of the same material by plotting the stress *versus* the number of cycles (or blows) for failure. Calculation of the maximum stress resulting from the impact is discussed. Agreement between the two series of tests indicates that the phenomenon of fracture after repeated blows is the same as that occuring in fatigue.

Thursday, July 1 2 p.m. Thirteenth Session

Held Simultaneously with Fourteenth Session

Effect of Temperature, Fatigue

Report of Joint Research Committee on Effect of Temperature on the Properties of Metals. N. L. Mochel, Chairman.

A brief summary of the progress made during the year in the various research projects sponsored by the joint committee. These include tests of tubular members subject to internal pressures, relaxation tests, effect of variables on the high-temperature properties of metals, and comparison of short-time test methods.

Informal Report of Joint Committee on Definitions of Terms Relating to Heat Treatment. H. S. Rawdon, Chairman.

This informal progress report presents a summary of considerations given by the joint committee to revisions in the definitions of terms relating to heat-treatment of metals.

Report of Committee E-8 on Nomenclature and Definitions. Cloyd M. Chapman, Chairman.

This progress report discusses briefly reviews made during the year of definitions prepared by other committees of the Society; also submits complete revision of tentative definitions of terms relating to heat-treatment of metals.

The Effect of Temperature on the Transition from a Ductile to a Brittle Type of Fracture in Several Low-Alloy Steels. Paul G. Jones, University of Illinois.

The conditions which tend to promote embrittlement of a steel include a high speed of straining, triaxial stress, and low temperature. Results are presented of impact tests made to determine the embrittlement effect of temperature and of state of stress on four low-alloy high-strength steels and a bridge steel. The tests included notched impact-bending and notched and unnotched impact-tension tests made in a Charpy impact machine at temperatures ranging from −70 F. to 390 F. Tests were also made to determine the effect of direction of rolling and overstraining on bridge steel.

The Technical Cohesive Strength and Other Mechanical Properties of Metals at Low Temperatures. D. J. McAdam, Jr., and R. W. Mebs, National Bureau of Standards.

Part I of this paper shows the influence of low temperature on diagrams representing the technical cohesive strength of metals. By comparison of diagrams obtained at different temperatures, a study is made of the influence of the combination of principal stresses, plastic deformation, and temperature on yield stress, ultimate stress, technical cohesion limit, and ductility.

Part II presents additional diagrams showing the quantitative influence of temperature on the strength of metals. Comparison is made between the effects of temperature on strength and on certain physical properties. The results lead to conclusions of theoretical and practical importance.

Interpretation of Creep-Test Data. P. G. McVetty, Westinghouse Electric and Mfg. Co.

The urgent need for creep data on a wide variety of heat-resisting alloys has emphasized the problem of producing the maximum useful output from available creep-testing equipment. Under present conditions, long-time creep tests are justified only when allowable deformation within the expected service life is the criterion of failure. The relations among the four variables—stress, strain, time, and temperature—and effects of various contributing factors are discussed and illustrated. This analysis leads to simple charts suitable for comparison of materials, formulation of effective testing programs, and guidance in the selection of safe working stresses for high-temperature service.

A New Chart for Estimating Working Stresses of Alloys at Elevated Temperatures. A. Nadai and P. G. McVetty, Westinghouse Electric and Mfg. Co.

The use of creep tests as the basis for comparison of existing and new alloys requires careful correlation of the test results to ensure the most economic use of available testing equipment. To reduce the time required, it is customary to conduct tests at stresses higher than those used in service and estimate from them the performance of the material under actual service conditions. This paper departs from the usual log-log plot and shows a new chart which utilizes the hyperbolic sine function for connecting the stress with the rate of creep. The development of the chart is described and it is shown how easily it can be constructed from one single curve. Examples illustrate its application to a variety of materials to obtain estimates of stress for specified low creep rates.

Report of Research Committee on Fatigue of Metals. H. F. Moore, Chairman.

The committee has been continuing the study of effect of size of specimens on fatigue of metals and a second progress report on this investigation is appended.

Appendix:

Second Progress Report on the Effect of Size of Specimen on Fatigue Strength of Three Types of Steel. H. F. Moore and D. Morkovin, University of Illinois.

Further tests on the effect of size on the fatigue strength of notched specimens of two plain carbon steels (S.A.E. 1020 and S.A.E. 1035) and on one heat-treated chrome molybdenum steel (S.A.E. X4130) have been made at the Talbot Materials Testing Laboratory at the University of Illinois, and the results of these tests correlated with the results of tests of unnotched specimens of the same steels reported last year. The scheme of cutting specimens of different sizes from the bars of steel and the testing machines used were the same as reported last year.

The Effect of Overstressing and Understressing in Fatigue. J. B. Kommers, University of Wisconsin.

Overstressing tests were made on two Armco irons and one steel to determine damage curves for various numbers of cycles. These damage curves show the changes that take place in the value of the endurance limit while the overstress test proceeds. Understressing tests were made on smooth specimens of annealed Armco iron. These tests show how the endurance limit increases with increase in numbers of cycles. They also show how the endurance life is increased by understressing plus subsequent coaxing.

The Fatigue Properties of Some Cold-Drawn Nickel Alloy Wires. John N. Kenyon, Columbia University.

Presents fatigue data on eight cold-drawn nickel alloy wire materials wherein the curves were carried out to 100×10^6 cycles. The materials were commercially drawn and so tested that fatigue failure could occur at any point within a 15-in. length. The data is of interest for comparison with that obtained with the standard beam machine. An interesting range of moduli values are reported for the various alloys and treatments.

Fatigue Tests on Some Copper Alloys in Wire Form. H. L. Burghoff and A. I. Blank, Chase Brass and Copper Co.

Presents the results of rotating arc fatigue tests upon hard-drawn, 0.072-in. diameter wires of several copper alloys, including four brasses or copper-zinc alloys, two copper-tin alloys, two tin-bearing brasses, two silicon bronzes, and two age hardened alloys containing nickel and phosphorus.

The influence of composition and of temper is discussed. For the brasses, endurance limit is maximum between 10 and 20 per cent zinc. Both tin and silicon markedly increase fatigue resistance. The highest endurance limits are attained by the copper-nickel-phosphorus alloy as age hardened and severely cold drawn.

Thursday, July 1 2 p.m. Fourteenth Session

Held Simultaneously with Thirteenth Session

Cementitious Materials

Report of Committee C-7 on Lime. W. C. Voss, Chairman.

A progress report reviewing briefly the activities of the committee.

Increasing the Reflectivity of Standard Portland Cement Concretes by Additions of Hydrated Lime. C. W. Muhlenbruch and Ben Marcin, Carnegie Institute of Technology.

Continuing the work reported at the 1942 Annual Meeting in a paper entitled "Factors Influencing the Reflectivity of White Portland Cement Concretes," additional studies have been made of the effect upon reflectivity of ordinary portland cement concretes caused by the addition of hydrated lime.

It has been found that the reflectivity of standard portland cement concretes, using river sand or white sand and river gravel, can be raised 15 percentage points by the addition of 30 per cent hydrated lime. Intermediate data indicate the relative reflectivities for various additions of lime. The decrease in reflectivity of specimens subjected to atmospheric exposure is slightly less than that found for white portland cement concretes. After 25 cycles of freez-

ing and thawing the white sand specimens, when mixed with any percentage of lime, show a slight loss of reflectivity. The effect of the additions of lime upon the compressive strength is also discussed.

The results of the tests show that suitable, although not a maximum reflectivity, can be obtained using ordinary portland cement, a light-colored fine aggregate, and hydrated lime.

Measurement of Bond Between Bricks and Mortar. J. C. Pearson, Lehigh Portland Cement Co.

An attempt to evaluate the performance of masonry mortars by various tests of bond that have been proposed or used gave very erratic and unsatisfactory results. This experience led to a search for an improved method of testing bond, and two such methods. The study is critical and emphasizes the limitations inherent in all mortar bond tests.

Report of Committee C-1 on Cement. P. H. Bates, Chairman.

Presents a complete revision of the tentative methods of test for compressive strength of portland-cement mortars and recommends the test for autoclave expansion of portland cement for adoption as standard with revisions. An interesting summary is presented of considerations being given to new chemical methods, study of air permeability test for fineness, tests of 121 commercial cements for sulfate resistance, a new method for heat of hydration of portland cement, and inspection work of the cement reference laboratory.

Appendix:

Notes on the Effect of Alkalies in Portland Cement on the Durability of Concrete.

This Appendix to the Report of Committee C-1 presents some notes relating to the problems of the working committee on The Effect of Alkalies in Portland Cement on the Durability of Concrete. This material has been contributed by the chairman of that subcommittee, by some of its members, and by others.

Studies to Develop an Accelerated Test Procedure for the Detection of Adversely Reactive Cement-Aggregate Combinations. T. E. Stanton, California Division of Highways.

The phenomena of excessive expansion of concrete through some reaction between aggregate and cement is discussed and the search for some accelerated test procedure to determine the potential adverse reaction characteristics of any cement-aggregate combination is described.

Tests discussed include (1) chemical analyses of both aggregate and cement; (2) mineralogical and petrographic studies; (3) Reaction of cement-aggregate combinations in sodium hydroxide solutions; (4) dynamic (sonic) frequency changes with relation to expansion; (5) curing procedure; (6) effect of curing temperatures—temperature studies made at 70, 110, and 130 F.

A Study of the Heat of Solution Procedure for Determining the Heat of Hydration of Portland Cement. Leo Shartsis and Edwin S. Newman, National Bureau of Standards.

The reproducibility of the method of measuring heats of hydration, by the difference between the heats of solution in acid of nonhydrated and hydrated cements (described in Federal Specification SS-C-158a) was investigated through a study of data accumulated in routine testing. The data obtained by a slightly modified method were also studied to determine their precision. The isothermal heat of solution and its temperature coefficient were determined for zinc oxide in the acid mixture prescribed by the specification. The temperature coefficient of the heat of solution of a dry cement was determined, and those of the heat of hydration and of the heat of solution of hydrated cement were calculated. Means of improving the accuracy and precision of the method are discussed.

Strength Variations in Portland Cement Conforming to the Same Specifications. S. P. Wing and Arthur Ruettgers, Bureau of Reclamation.

Strength variations found in several million barrels of cement of various brands purchased for a large dam are shown by a statistical analysis of cement acceptance tests. The effect of job-blending of the cements is indicated; also the degree to which strength fluctuations remaining in the blended cement were reflected in routine 28-day concrete control cylinders. Finally the significance of cement-strength differences evidenced at early ages is discussed in the light of extensive laboratory tests of concrete specimens made with 36 cements and broken at ages up to 5 yr.

Thursday, July 1 8 p.m. Fifteenth Session

Concrete

Report of Committee C-8 on Refractories. J. D. Sullivan, Chairman.

This report records completion of new specifications for air-setting refractory mortars for boiler furnace and incinerator service, and five methods of test for sieve analysis and water content of refractory materials, combined drying and firing shrinkage of fireclay plastic refractories, panel test for resistance to thermal and structural spalling of fireclay plastic refractories, workability index of fireclay plastic refractories, and test for thermal conductivity of insulating refractories recently accepted by Committee E-10 on Standards, and which are published in the 1943 Manual of A.S.T.M. Standards on Refractory Materials. A review is also given of the other activities of the committee during the year.

Report of Committee C-9 on Concrete and Concrete Aggregates. F. H. Jackson, Chairman.

The committee has under consideration revisions of the following methods: Tests for structural strength of fine aggregate using constant water-cement-ratio mortar, soundness of aggregates by use of sodium sulfate or magnesium sulfate, sieve analysis of fine and coarse aggregates, efficiency of materials for curing concrete, and volume change of cement mortar and concrete. A revised method of test for surface moisture of fine aggregate is being developed, and methods for determining water gain, making concrete test specimens from vibrated concrete, rate of loading of concrete test specimens, tests for uniformity of concrete proportions, and freezing-and-thawing tests of concrete.

Simplified Test for Evaluation of Mixing Effectiveness of Concrete Mixers. S. P. Wing, V. Jones and R. E. Kennedy, Bur. of Reclamation.

The development from the Patch mixer efficiency test of a rapid, simple procedure for evaluating the performance of concrete mixers is discussed and compared with the original method. Some 2000 wet analyses of samples from 2-cu. ft. and 5-cu. yd. mixers were available as test data. The simplified test evaluates mixer performance by means of the variations in the specific gravity of screened mortar samples taken from the mixer. These variations are correlated with variations in the compressive strength of cylinders taken from the same batch. From characteristic graphs of mixer performance, coefficients for both batching and mixer efficiency are derived. Use of the test for routine control of concrete manufacture is illustrated.

Effect of Membrane Curing upon the Durability and Strength of Concrete. Bartlett G. Long and H. J. Kurtz, Cincinnati Testing Laboratory, War Dept.

The use of concrete curing compounds (in lieu of the more familiar method of applying water, or water-saturated materials) in the curing of concrete is briefly discussed. A laboratory test procedure employing determinations of flexural strength, compressive strength, moisture change, and dynamic modulus-of-elasticity, to evaluate the relative effectiveness of a few commercial curing compounds, is presented and illustrated. Dynamic modulus-of-elasicity values determined on panels of a four-year-old concrete test wall, are also presented for comparison with similar values obtained in the laboratory tests. A new method of obtaining the dynamic modulus-of-elasticity of concrete *in situ* is briefly described.

A New Aspect of Creep in Concrete and Its Application to Design. Douglas McHenry, Bureau of Reclamation.

The nature of creep and recovery are discussed, and a principle is stated which governs the superposition of creep when the load varies with time. An equation is developed which defines creep as a function of stress, age at loading, and elapsed time after loading. This creep equation, combined with the superposition principle, provides a means for expressing the strain history when the stress history is known. The treatment indicates that problems of concrete design may be solved by the methods of conventional elasticity, provided the true loads or displacements are replaced by certain fictitious loads or displacements. Numerous laboratory tests which form the basis and verification of treatment are described.

Effect of an Air-Entrapping Admixture on the Resistance to Freezing and Thawing of Concrete Containing Inferior Coarse Aggregate. E.O. Axon, T.F. Willis, and F.V. Reagel, Missouri State Highway Dept.

The detrimental effect of certain economically available coarse aggregates, on the resistance of concrete pavements to freezing and thawing, has been the subject of considerable study by the Missouri Highway Department for several years.

This paper describes the results of tests of concretes containing four different coarse aggregates, two limestones, and two chert gravels, and cement ground with Vinsol Resin. Based on service records of several hundred miles of pavement these aggregates were rated, respectively, as excellent, fair, mediocre, and poor. The primary study was directed toward the resistance of the concrete to freezing and thawing. This was examined under two different test procedures, one developed and used in this laboratory and the other essentially similar to one used by the Portland Cement Association. Secondarily the effect of Vinsol Resin on some of the other properties of concrete was also studied.

Miscellaneous Business.

Tanker "Schenectady" Failure

ACCORDING TO the report of a special committee of investigation appointed by the American Bureau of Shipping, an abstract of the report having appeared in *Engineering News-Record*, March 25, the failure of the all-welded steel hull of the 16,500-ton tanker *Schenectady*, which split in two while floating at dock in Portland, Ore., was due to a combination of circumstances, the principal cause of failure being an accumulation of an abnormal amount of internal stress, locked into the structure by the processes used in construction, together with an acute concentration of stress caused by defective welding at the starboard gunwale, augmented by the hogging stress due to the balasted condition (the fore and aft tanks being loaded, while the tanks amidship were empty). The accumulation and concentration of stress caused a tensile failure at the starboard sheer strake, which was formed of steel of substandard quality, all of which was aggravated to some degree by a drop in atmospheric temperature.

In listing factors contributing to the failure, the committee placed particular emphasis on the lack of good welding technique and departures from recognized fundamentals of good welding in an effort to speed up construction. The committee also points out that there was a serious accumulation of shrinkage stresses as a result of the automatic machine welding of the longitudinal joint at the gunwale attaching the sheer strake to the stringer plate. This particular welded joint, where the failure is said to have started, is said to have been poorly located and to have evidenced not only a longitudinal crack, but also minute transverse cracks in the weld. A further contributing factor was revealed by tests of the particular sheer strake where the fracture apparently started, which showed a steel of substandard quality as compared with other plates investigated, particularly as to strength and brittleness; cited qualities are a 10,000-psi. proportional limit, low Charpy impact value, and brittleness in the notch-bend test.

The committee pointed out that there was no evidence of the ship having grounded on a bank of silt under the amidship portion, and none to indicate that a slight seismic disturbance, reported at the time of the failure, could have been a contributing factor to the ship's failure.

In commenting on the failure, *Engineering News-Record* in its editorial "Familiarity Breeds Carelessness" expressed the reassuring conclusion that accepted good practice could have prevented the failure and that steel manufacturers, designers, and research engineers were called to the same bar of accounting as the fabricator. "More care in construction, better understanding of design, clearer insight into welding phenomena generally, are the demands which this tanker failure emphasize."

EDITOR'S NOTE.—In view of the interest of many members in this ship failure, the above notes are recorded. Several A.S.T.M. members were on the investigating committee including: La Motte Grover, Structural Welding Engineer, Air Reduction Sales Co.; Harry W. Pierce, Welding Engineer, New York Shipbuilding Corp.; S. H. Graf, Professor of Mechanical Engineering and Director of Engineering Research, Oregon State College; and David Arnott, Vice-President, Chief Surveyor, American Bureau of Shipping.

General view of turbine gallery, large western dam. Shafts from the waterwheel turbines below the floor drive large generators furnishing almost a half million kva. This photograph is of interest in connection with some of the emergency specifications for turbine and generator parts issued by A.S.T.M. early this year through the work of a National Emergency Steel Specifications group.

WPB Administrators of Steel Orders

VARIOUS EXECUTIVES in the Iron and Steel Division of the War Production Board have been appointed as administrators of limiting orders coming under Limitation Order L-211. Most of these schedules listing acceptable steel specifications have been published in previous issues of the BULLETIN. A list of the administrators and products covered in the L-211 schedules follow:

No. of Schedule	Products Covered	Date of Issue	Administrator	Room in Social Security Building	Extension Telephone: Republic 7500
1	Concrete Reinforcement Steel	Oct. 23, 1942	A. A. Wagner	1017	3875
2	Steel Wheels and Tires	Oct. 23, 1942	George Hocker	1308	2391
3	Barbed Wire, Wire Fence, Poultry Netting and Poultry Flooring	Nov. 12, 1942	Narman Froelich	1520 A	73930
4	Structural Steel Shapes	Feb. 25, 1943	M. W. Cole	1304	72404
5	Steel Axles and Forgings (Railroad and Transit Services)	Feb. 25, 1943	George Hocker	1308	2391
6	Mechanical Steel Tubing	Feb. 25, 1943	W. H. Wiewel	1413 A	73486
7	Rails and Track Accessories	Feb. 25, 1943	O. H. Baker	1009	4860
8	Carbon Steel Plates	Mar. 22,1943	M. W. Cole	1304	72404
9	Oil Country Tubular Goods	Apr. 30	J. W. Owings	1419 A	73034
10	Water Well Tubular Products	Apr. 30	J. W. Owings	1419 A	73034

All of these administrators are located in the Iron and Steel Division, and the room numbers and telephone numbers are as of April, 1943.

NEW MEMBERS TO APRIL 22, 1943

The following 66 members were elected from March 10 to April 22, 1943:

Chicago District

HARNISCHFEGER CORP., H. H. Erkelenz, Vice-President, 4400 W. National Ave., Milwaukee, Wis.

JOHNSON MOTORS, Joseph G. Rayniak, Vice-President, Waukegan, Ill.

VELSICOL CORP., J. Hyman, Executive Vice-President, 120 E. Pearson St., Chicago, Ill.

ANDERSON, A. G., Automotive Standards Engineer, International Harvester Co., Chicago, Ill. For mail: 1129 N. Massasoit Ave., Chicago, Ill.

BOWERS, HERMAN, Metallurgist, The Studebaker Corp., Aviation Division, South Bend, Ind. For mail: 124 Chaplain St., South Bend, Ind.

EVANS, ROBERT G. N., President and General Manager, Evans Engineering Co., 2930 W. Burleigh St., Milwaukee, Wis.

KRENZKE, WILLIAM F., Chief Engineer, Jacobsen Manufacturing Co., Racine, Wis. For mail: 520 English St., Racine, Wis.

SHEPHERD, ROBERT CARL, Chemical Engineer, Russell Electric Co., 340 W. Huron St., Chicago, Ill.

Cleveland District

UNION CHAIN AND MANUFACTURING CO., E. F. Emmons, President, Edgewater Ave., Sandusky, Ohio.

DERINGER, J. PAUL, Plant Metallurgist, Jack & Heintz, Inc., Plant 3, Solon Road, Bedford, Ohio.

FEDOR, JOSEPH J., Director, Control Laboratory, Ravenna Ordnance Plant, Atlas Powder Co., Apco, Ohio. For mail: 134 E. Oak St., Kent, Ohio.

Detroit District

MEYER ENGINEERING CO., John H. Romann, Consulting Engineer, 8745 Conant, Detroit, Mich. [S]†

BRIGGS MANUFACTURING CO., C. R. Wylie, Consulting Engineer, 11631 Mack Ave., Detroit, Mich.

MICHIGAN STATE PURCHASING DIVISION, Eugene A. Gump, Director, Lansing, Mich.

WHITE, GEORGE A., Production Engineer, Sparks-Withington Co., Horn Division, Jackson, Mich.

New York District

COLGATE-PALMOLIVE-PEET CO., Malcolm F. Graham, Assistant to Director of Standards and Quality Control Division, Research and Development Dept., 105 Hudson St., Jersey City, N. J.

HEYDEN CHEMICAL CORP., Mrs. Marjorie Malle, Librarian, River Drive, Garfield, N. J.

MATAM CORP., A. D. Glowinski, Vice-President, 45–17 Pearson St., Long Island City, N. Y. [S]

NATIONAL LEAD CO., Alex. Stewart, Director of Research, 105 York St., Brooklyn, N. Y. [S]

CAMPBELL, MALCOLM E., Staff Member, Textile Research Inst., Inc., Room 2701, 10 E. Fortieth St., New York, N.Y.

COCHIARELLI, JOHN M., Junior Engineer, 1547 Commonwealth Ave., Bronx, New York, N. Y. [J]*

CRAIG, HUGH, Editor, *Oil, Paint & Drug Reporter*, 59 John St., New York, N. Y.

FOSTER, J. S., Vice-President, Lidgerwood Manufacturing Co., 775 Lidgerwood Ave., Elizabeth, N. J.

JACOBUS, JULIAN S., Editor, *Textile Research*, Textile Research Inst., Inc., 10 E. Fortieth St., New York, N. Y.

KERR, LOUIS, Junior Engineer, U. S. Army Signal Corps, Newark Inspection Zone, Newark, N. J. For mail: 1415 E. New York Ave., Brooklyn, N. Y. [J]

LEWIS, R. H., Mechanical Section Engineer, Westinghouse Electric and Manufacturing Co., 95 Orange St., Newark, N. J.

WELCH, L. EARLE, Research Engineer, Bakelite Corp., Bloomfield, N. J.

Philadelphia District

ACCURACY SCIENTIFIC INSTRUMENT CO., B. H. Dabloff, Manager, Huntingdon St., below Jasper St., Philadelphia, Pa.

ESSEX RUBBER CO., J. Miscall, Director of Development, Box 501, Trenton, N. J.

FRANKLIN RESEARCH CO., W. J. LaRoche, Vice-President, 5134 Lancaster Ave., Philadelphia, Pa.

EASTERN REGIONAL RESEARCH LABORATORY LIBRARY, U. S. Department of Agriculture, Chestnut Hill Station, Philadelphia, Pa.

THOMAS, FRANCIS X., Chemist, Carnegie-Illinois Steel Corp., Pencoyd, Pa. For mail: 3353 Ridge Ave., Philadelphia, Pa. [J]

Pittsburgh District

UNITED OIL CO., H. K. Siefers, Chemist, Preble Ave. and N. Franklin St., N. S., Pittsburgh, Pa.

St. Louis District

LOUDER, EARL A., Technical Director, Pet Milk Co., Greenville, Ill.

Western New York — Ontario District

ROSS HEATER AND MANUFACTURING CO., INC., S. Townsend Tinker, Chief Engineer, 1407 West Ave., Buffalo, N. Y.

GYSEL, RICHARD W., Metallurgist, F. A. Smith Manufacturing Co., Inc., Box 509, Rochester, N. Y. [J]

JENKINS, EDWARD S., Chief, Structures Division, Curtiss-Wright Corp., Research Laboratory, Plant 5, Airport, Buffalo, N. Y.

SPENCER, RAY C., Metallurgist, Bliss & Laughlin, Inc., Box 945, Buffalo, N. Y.

THORBURN, ARTHUR FREDERICK, Petroleum Tester, Shell Oil Co. of Canada, Ltd., Toronto, Ont., Canada. For mail: 93 Glenmore Road, Toronto, Ont., Canada.

U. S. and Possessions

Other than A.S.T.M. Districts

BOOTT MILLS, Frederick A. Flather, Treasurer, 79 Milk St., Boston, Mass.

CURTISS-WRIGHT CORP., AIRPLANE DIVISION, D. Weinstein, Materials and Process Engineer, Crittenden Drive, Louisville, Ky.

ELECTRIC BOAT CO., A. T. Avery, Engineering Works Manager, Groton, Conn.

FARNSWORTH TELEVISION AND RADIO CORP., J. C. Ferguson, Chief Engineer, Fort Wayne, Ind.

LETOURNEAU, INC., R. G., Walter J. Brooking, Director of Testing and Research, Peoria, Ill.

RIVERSIDE & DAN RIVER COTTON MILLS, INC., L. A. Graybill, Danville, Va.

SHERMAN CONCRETE PIPE CO., Charles E. Cobb, Owner, Box 2348, Jacksonville, Fla.

ANDEREGG, REUBEN H., Vice-President and Chief Engineer, The Trane Co., Second and Cameron, La Crosse, Wis.

BURROUGHS, W. H., Quality Manager, The Glenn L. Martin-Nebraska Co., Fort Crook, Nebr. For mail: 4685 Pine St., Omaha, Nebr.

DECKER, RUDOLPH F., Metallurgist, Black River Foundries, South Haven, Mich. For mail: 113 Michigan Ave., South Haven, Mich. [J]

EIDMANN, HEINRICH OTTO, Structural Engineer, Grand Gorge, N. Y.

ELSE, H. D., Development Engineer, Westinghouse Electric and Manufacturing Co., Lima, Ohio.

GIDLEY, PHILIP T., Research Manager, Acushnet Process Co., New Bedford, Mass. For mail: 73 Green St., Fairhaven, Mass.

KEITH, JAMES A., Inspection Engineer of Materials of Naval Aircraft, U. S. Navy, Baltimore, Md. For mail: 4201 Chatham Road, Baltimore, Md.

LODDER, WILLIAM, Easy Washing Machine Corp., Syracuse, N. Y.

MULLIS, IRA B., Engineer of Materials and Tests, Pratt, Lassiter & Watkins, 403 Capital Club Building, Raleigh, N. C.

NEWCOMBE, J. W., Chief Chemist, D-A Lubricant Co., Inc.,

Indianapolis, Ind. For mail: 1311 W. Twenty-ninth St., Indianapolis, Ind.

RUPP, MUSSER F., Chief Testing Engineer, Reynolds Alloys Co., Listerhill, Ala.

SLAUGHTER, ELMER C., Supervisor, Experimental Dept., Lear Avia, Inc., Piqua, Ohio. [J]

STEPHENSON, L. J., Supervisor, Quality Control Laboratory, Westinghouse Electric and Manufacuring Co., Lima, Ohio.

WALLACE, GEORGE ELMER, Chemist, Stewart-Warner Corp., Indianapolis, Ind. For mail: 2205 Bellefountaine St., Indianapolis, Ind. [J]

WINTERS, ROY S., Purchasing Agent, City of Muskegon, Department of Public Works, Muskegan, Mich.

Other than U. S. and Its Possessions

HUGHES AND CO. LIMITED, F.A., A. B. Lisle, Manager, Metals Dept., Lumn's Lane, Swinton, Manchester, England.

BRAZILIAN MINISTERIO DA AERONAUTICA, SERVICO TECNICO DA AERONAUTICA, J. Cecilio Arruda, Captain, Rua Viscon de Gtaborahy 80, 1° Andar, Rio de Janeiro, Brazil.

HERBERT, THOMAS MARTIN, Research Manager, London Midland and Scottish Railway Co., Watford, Herts, England.

INSTITUTIO DE PESQUISAS TECNOLOGICAS, Caixa Postal 141-A, São Paulo, Brazil.

PRADO, JOSÉ LORENZO, Director, Laboratorio Nacional, Caracas, Venezuela.

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* [J] — Denotes Junior Member.
† [S] — Denotes Sustaining Member. See article on Sustaining Members, p. 33.

Personals

• • • News items concerning the activities of our members will be welcomed for inclusion in this column.

ROBERT L. STREETER, formerly County and City Engineer, County of Campbell at Gillette, Wyo., is for the present Project Engineer with Fisher & Fisher—Architect-Engineer on a War Housing Project, Sidney, Nebr. He is permanently connected with Crocker & Ryan, Consulting Engineers, Denver, Colo.

CLINTON GROVE, formerly with the Technical Service Division, United Color and Pigment Co., Newark, N. J., is now with the Staso Milling Co., Bound Brook, N. J.

S. FRANK COX, formerly Technical Director, Double Glazing Division, Pittsburgh Plate Glass Co., is now Director of Research, Glass Division, Pittsburgh Plate Glass Co., Creighton, Pa.

FRANK WILCOXON is now Chief Chemist, Insecticide and Fungicide Laboratory, American Cyanamid Co., Stamford, Conn. He was Director, Control Laboratory, Ravenna Ordnance Plant, Atlas Powder Co., Ravenna, Ohio.

J. HALMER HAYNER has resigned as Senior Materials Engineer, Conservation Division, WPB, Washington, to become Assistant Chief Metallurgical Engineer, Eclipse-Pioneer Division, Bendix Aviation Corp., Bendix, N. J.

T. SMITH TAYLOR, is now Chief, Development Dept., Federal Telephone and Radio Corp., Selenium Rectifier Division, East Newark, N. J. He was formerly Professor in Charge of Research and Graduate Studies, Newark College of Engineering, Newark, N. J.

WILLIAM J. WOOLDRIDGE has retired from Allegheny Ludlum Steel Corp., Brackenridge, Pa., where he was employed as Sales Engineer.

ARNOLD J. EICKHOFF, formerly Materials Engineer (Paints and Chemicals), U. S. Maritime Commission, Washington, D. C., is now Paint Chemist, National Lead Co., Brooklyn, N. Y.

MEYER CHISDES is now connected with the Lithaloys Corp., Long Island City, N. Y., as Chemist. He was formerly Chemist, The Port of New York Authority, New York, N. Y.

ROY A. SHIVE, who was Research Chemist, Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., is now Principal Chemist, Rubber Reserve Co., U. S. Government, Washington, D. C.

JOSEPH J. MATTIELLO, formerly Technical Director, has been elected Vice-President of the Hilo Varnish Corp., Brooklyn, N. Y. He has been with the firm since 1925 and since 1934 has been a director.

ORVILLE T. BARNETT, who was Engineer of Tests, Metal and Thermit Corp., Jersey City, N. J., has been made Production Engineer for both arc welding and thermit welding divisions of the company.

CHARLES J. HUBER, Vice-President of the United States Testing Co., Inc., Hoboken, N. J., and a well-known silk expert and textile engineer, has accepted the position of Development Engineer for Johnson & Johnson, New Brunswick, N. J.

C. F. HANSON, formerly Technical Director, Irvington Varnish and Insulator Co., Irvington, N. J., has been appointed Chief Consulting Engineer and will be responsible for expediting technical work on war production.

ROBERT H. LEACH, Vice-President, In Charge of Production and Research, Handy & Harman, Bridgeport, Conn., on April 22 received the Wetherill Medal of the Franklin Institute for his work in the field of low-temperature brazing alloys.

E. H. BUCY, Chief of the Protective Coatings Section, War Production Board, has resigned to return to private industry, Atlas Powder Co., Stamford Conn., where he has been Technical Director of the Zapon Division.

ALFRED SUGAR, previously with Monarch Aluminum Manufacturing Co., Cleveland, Ohio, is now connected with U. S. Metals Refining Co., Carteret, N. J.

THE SONNTAG SCIENTIFIC EQUIPMENT CORP., Greenwich, Conn., has recently changed its name to the Sonntag Scientific Corp. and it is announced that in addition to the development and design of special testing machines and instruments which are exclusively sold through the Baldwin Southwark Division, The Baldwin Locomotive Works, the company does development work on and manufactures high-speed balancing machines for Gyro-Balance Corp. The company further engages in commercial research covering materials fatigue and vibration problems. B. J. LAZAN, former Assistant Professor of Engineering Mechanics, Pennsylvania State College, has been appointed Chief Engineer.

AMERICAN MACHINE AND METALS, INC., East Moline, Ill., has announced the appointment of Albert S. Rairden as Sales Manager of the Riehle Testing Machine Division. For the past ten years Mr. Rairden has been associated with the Wickwire Spencer Steel Co. He is a graduate of Massachusetts Institute of Technology, and will make his headquarters in East Moline, Ill.

M. A. SWAYZE, Director of Research, Lone Star Cement Corp., Hudson, N. Y., received the Wason Medal for noteworthy research for the work reported in his paper, "Early Concrete Volume Changes and Their Control," at the annual convention of the American Concrete Institute.

W. B. LINCOLN, JR., is on leave of absence from his company, Inland Container Corp., Indianapolis, Ind., and is now Principal Supply Specialist, Packing and Crating Section, Office of Quartermaster, Washington, D. C.

T. N. ARMSTRONG, Metallurgist, The International Nickel Co., New York, N. Y., is now also a part-time member of the staff of the War Metallurgy Committee of the National Academy of Sciences, National Research Council.

Mr. Armstrong's work for the International Nickel Co. on the development of alloy steels, as well as his earlier metallurgical work at the Norfolk Navy Yard, particularly fits him for his assignments in his new position as a Research Supervisor for the War Metallurgy Committee. His principal responsibilities are the direction of research on steel foundry products and on the low-temperature properties of metals. These are two of the major fields in which the War Metallurgy Committee is directing metallurgical research projects on instruments of warfare for the National Defense Research Committee of the Office of Scientific

Research and Development, and on metal production problems for the Office of Production Research and Development of the War Production Board.

EDITOR'S NOTE.—A number of other members of the Society are associated with Mr. Armstrong as members of the Advisory Committee on the Low-Temperature Research Project. The personnel includes Messrs. R. S. Archer, Glen Riegel, E. O. Dixon, Sam Hoyt, Harry G. Miller, and V. N. Krivobok. Representatives of the Armed Services and of the War Production Board are also on the committee, and a representative of the Joint A.S.T.M.-A.S.M.E. Research Committee on Effect of Temperature on the Properties of Metals may also be appointed. This research project is the outgrowth of discussions in A.S.T.M. Committee A-1 on Steel and the Joint Research Committee.

C. E. BALES, Vice-President, The Ironton Fire Brick Co., was elected President of the American Ceramic Society at its 45th Annual Meeting held in Pittsburgh, Pa., on April 19. Mr. Bales has been very active in the work of A.S.T.M., notably in Committee C-8 on Refractories. He is a member of the C-8 Advisory Committee and a number of subcommittees, and in the group concerned with tests is Chairman of the Section on Slagging. Mr. Bales for the past two years has been President of the Ohio Ceramic Industries Association and is a director of the American Refractories Institute. He is a member of a number of other technical and trade organizations.

LEROY L. WYMAN, Metallurgist for some nineteen years, with the General Electric Co., Research Laboratory, at Schenectady, has been released for the emergency by his company to join the staff of the War Metallurgy Committee of the National Academy of Sciences, National Research Council. His professional interests and activities have covered a wide field in the metal research problems of the General Electric Co. Outstanding in such activities has been his work on hard carbides, steel treatment, heat-resistant alloys and refractory materials. Mr. Wyman became a Research Supervisor of the War Metallurgy Committee on April 1, with his principal assignment the direction of research in the fields of non-ferrous alloys used in aircraft and ordnance matériel. In A.S.T.M. Mr. Wyman will continue as chairman of Committee E-4 on Metallography, and represents his company on other A.S.T.M. technical groups.

Announcement has been received from JOHN M. WEISS of the formation of a company in his name which will offer professional engineering and economic services. With the organization of this new company the firm of Weiss & Downs, Inc., has become inactive.

CROSBY MILLER was recently promoted from the position of Bridge Engineer for the Chesapeake & Ohio Railway Co. to that of Assistant Chief Engineer, with headquarters in Richmond, Va.

John A. Newlin (1872–1943)

In the death of John A. Newlin, Specialist in the Mechanics of Wood, U. S. Forest Products Laboratory, Madison, Wis., the Society loses a long-time and active member who in his particular field of specialization contributed much of value in forwarding the Society's work. An outstanding authority on the use of wood as an engineering material, he had only recently retired after almost 40 years of service with the Federal Government—from 1910 to 1938 he was Chief of the Division of Timber Mechanics at the U. S. Forest Products Laboratory. His early industrial work was as Civil Engineer in the railroad field. During the last war he was in charge of the design and assembly of wood aircraft parts for the United States Navy. A notable development under his direction has been a system of prefabricated plywood house construction. He had been a member of the A.S.T.M. since 1913, and served on Committee D-7 on Timber since that time, acting as secretary for over 27 years. He also served on other A.S.T.M. groups. He contributed a number of technical reports and several papers published in the A.S.T.M. *Proceedings*.

A. C. Badger (1893–1943)

The very sudden death on March 31 of A. C. Badger, Metallurgical Engineer, Youngstown Sheet and Tube Co., Youngstown, Ohio, came as a distinct shock to his many friends and associates in the Society. A member of A.S.T.M. continuously since 1914, he had served for many years on Committees A-1 on Steel, A-5 on Corrosion of Iron and Steel, and had been a member of other technical groups. While his chief activities in the Steel Committee were in the field of pipe and tubing, he was also a member of the subcommittees on sheets, commercial bars, and structural steel, representing his company. Like many A.S.T.M. members, Mr. Badger had been contributing notably to the war effort. He was a member of the Ferrous Metallurgical Advisory Board of the War Department. During the first war, he was an advisory metallurgist at Watertown Arsenal. He is survived by his widow and two sons.

Valve Order L-252 Revised

WPB LIMITATION ORDER L-252, issued in January to reduce the types of gate, globe, angle, cross, and check valves, was revised in April to eliminate certain specifications of physical properties of some of the steels contained in the original order. The changes cover specifications of bodies and bonnets, bonnet bolting, and bonnet bolt nuts of steel valves.

The order is intended exclusively to conserve materials and to raise production by simplifying valves and valve parts. Specifications of physical characteristics of materials, on the other hand, relate to standards of efficiency or safety, which are governed by the contracts between producers and their customers, WPB said. The inclusion of such specifications in L-252 is not considered necessary.

Preprints

By virtue of membership in the Society, each member or representative of a company membership has the privilege of requesting a copy of those papers and committee reports that are printed in advance of their presentation at the annual meeting. The obtaining of this material (through a printed request blank sent to each member early in May) is one of the distinct assets of Society membership, since it gives members an advance picture of some of the major problems to be covered at the A.S.T.M. meeting.

At the same time it provides him promptly with some of the latest information and authoritative data that have been developed on various engineering materials. Through the committee reports and the proposed specifications and tests frequently published therein a member can gain in advance a conception of just what leading technical representatives of producers and consumers agree need to be covered in a test or purchase standard.

While not all of the material presented at the annual meeting can be distributed in preprint form, a very intense effort is made to have all committee reports preprinted, so that actions requested from the Society by the technical committees can be fully covered. In recent years the batting average on preprinting has been very high (usually about 1000 pages) and even where a paper or report was received too late for setting in type and advance distribution, abstracts or extended synopses have frequently been available at the meeting.

Since the A.S.T.M. *Proceedings* with final reports and final edited papers and discussion usually cannot be distributed until December, the preprints are early available sources of information.

A CORDIAL INVITATION is extended to all who are concerned with engineering materials to become members of the Society.

Complete List of A.S.T.M. Emergency Specifications and Emergency Alternate Provisions

EDITOR'S NOTE.—To provide a readily accessible and convenient reference for members who wish to have a complete list of all emergency specifications and emergency alternate provisions (pink slips) each issue of the BULLETIN will give the latest list at the time the BULLETIN goes to press. This feature suggested by the Executive Committee will appear as the last page or two of BULLETIN text immediately preceding the professional card page in the back advertising section.

May 8, 1943

Emergency Specifications for[1]

ES–1a	Lead-Coated and Lead-Alloy Coated Copper Wire for Electrical Purposes.
ES–2	Lead Coating (Hot-Dip), on Iron or Steel Hardware.
ES–3	Conducting Salt Spray Tests on Organic Protective Coatings. (Method)
ES–4	*Discontinued*, Replaced by Standard Hardness Conversion Table for Cartridge Brass. (Relationship Between Diamond Pyramid Hardness, Rockwell Hardness, and Brinell Hardness) (E 33–42)
ES–5a	Carbon-Chromium Ball and Roller-Bearing Steels.
ES–6	Rubber Sheath Compound for Electrical Insulated Cords and Cables Where Extreme Abrasion Resistance Is Not Required.
ES–7	Fire-Refined Copper for Wrought Products and Alloys.
ES–8	85 Per Cent Magnesia Thermal Insulating Cement.
ES–9	Long Fiber Asbestos Thermal Insulating Cement.
ES–10	Mineral Wool Thermal Insulating Cement.
ES–11	Expanded or Exfoliated Mica Thermal Insulating Cement.
ES–12	Diatomaceous Earth Thermal Insulating Cement, for Use from 600 to 1200 F.
ES–13	Diatomaceous Earth Thermal Insulating Cement, for Use from 1200 to 1900 F.
ES–14	Blanket Thermal Insulation for Building Purposes.
ES–15	Blanket Thermal Insulation for Industrial Purposes.
ES–16	Blanket Thermal Insulation for Refrigeration.
ES–17	Preformed Pipe Covering Thermal Insulation.
ES–18	Preformed Block Thermal Insulation.
ES–19	Structural Board Thermal Insulation.
ES–20	Malleable Iron Flange, Pipe Fittings, and Valve Parts.
ES–21	Carbon-Steel and Alloy-Steel Forgings for Magnetic Retaining Rings for Turbine Generators.
ES–22	Alloy-Steel Forgings for Nonmagnetic Coil Retaining Rings for Turbine Generators.
ES–23	Carbon-Steel Forgings for Rings for Main Reduction Gears.
ES–24	Carbon-Steel and Alloy-Steel Forgings for Pinions for Main Reduction Gears.
ES–25	Carbon-Steel and Alloy-Steel Forgings for Turbine Generator Rotors and Shafts.
ES–26	Carbon-Steel and Alloy-Steel Forgings for Turbine Rotors and Shafts.
ES–27	Carbon-Steel and Alloy-Steel Forgings for Turbine Bucket Wheels.
ES–28	Chloroprene Sheath Compound for Electrical Insulated Cords and Cables.
ES–29	Special Quality Aluminum Die Castings.
ES–30	Chloroprene Sheath Compound for Electrical Insulated Cords and Cables when Extreme Abrasion Resistance Is Not Required.

[1] Available in separate pamphlet form.

[2] Available as "pink slips" affixed to each of the separate respective specifications and published in various issues of the ASTM BULLETIN as indicated by footnotes. Complete set to be furnished with respective parts of the 1942 Book of Standards.

[5] March, 1942 ASTM BULLETIN.
[6] May, 1942 ASTM BULLETIN.
[7] August, 1942 ASTM BULLETIN.
[8] October, 1942 ASTM BULLETIN.
[9] December, 1942 ASTM BULLETIN.
[10] January, 1943 ASTM BULLETIN.
[11] May, 1943 ASTM BULLETIN.

Emergency Alternate Provisions in Specifications for[2]

Steel

EA–A 1	Open-Hearth Carbon-Steel Rails (A 1–39).[7]
EA–A 21	Carbon-Steel Axles for Cars and Tenders (A 21–39).[8]
EA–A 25a	Wrought Steel Wheels for Electric Railway Service (A 25–41).[9]
EA–A 26	Steel Tires (A 26–39).[6]
EA–A 27	Carbon-Steel Castings for Miscellaneous Industrial Uses (A 27–42).[5]
EA–A 53	Welded and Seamless Steel Pipe (A 53–42).[10]
EA–A 57	Multiple-Wear Wrought Steel Wheels (A 57–39).[7]
EA–A 67	Steel Tie Plates (A 67–33).[7]
EA–A 83	Lap-Welded and Seamless Steel and Lap-Welded Iron Boiler Tubes (A 83–42).[8]
EA–A 87	Carbon-Steel and Alloy-Steel Castings for Railroads (A 87–42).[5]
EA–A 120	Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses (A 120–42).[8]
EA–A 134	Electric-Fusion-Welded Steel Pipe (Sizes 30 in. and Over) (A 134–42).[8]
EA–A 135	Electric-Resistance-Welded Steel Pipe (A 135–42).[8]
EA–A 139a	Electric-Fusion-Welded Steel Pipe (Sizes 8 in. to but not Including 30 in.) (A 139–42).[11]
EA–A 148a	Alloy-Steel Castings for Structural Purposes (A 148–42).[11]
EA–A 160	Axle-Steel Bars for Concrete Reinforcement (A 160–39).[7]
EA–A 161	Seamless Low-Carbon and Carbon-Molybdenum Steel Still Tubes for Refinery Service (A 161–40).[8]
EA–A 167	Corrosion-Resisting Chromium-Nickel Steel Sheet, Strip, and Plate (A 167–42).[7]
EA–A 177	High-Strength Corrosion-Resisting Chromium-Nickel Steel Sheet and Strip (A 177–42).[7]
EA–A 178	Electric-Resistance-Welded Steel and Open-Hearth Iron Boiler Tubes (A 178–40).[8]
EA–A 179	Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes (A 179–42).[8]
EA–A 183	Heat-Treated Carbon- and Alloy-Steel Track Bolts and Nuts (A 183–40 T).[7]
EA–A 186	One-Wear and Two-Wear Wrought Steel Wheels (A 186–39).[7]
EA–A 190	Lightweight and Thin-Sectioned Gray-Iron Castings (A 190–40).[7]
EA–A 192	Seamless Steel Boiler Tubes for High-Pressure Service (A 192–40).[8]
EA–A 194	Carbon and Alloy-Steel Nuts for Bolts for High-Pressure and High-Temperature Service to 1100 F. (A 194–40).[6]
EA–A 199	Seamless Cold-Drawn Intermediate Alloy-Steel Heat-Exchanger and Condenser Tubes (A 199–40).[8]
EA–A 200	Seamless Intermediate Alloy-Steel Still Tubes for Refinery Service (A 200–40).[8]
EA–A 209	Seamless Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes (A 209–42).[8]
EA–A 211	Spiral-Welded Steel or Iron Pipe (A 211–40).[8]
EA–A 213	Seamless Alloy-Steel Boiler and Superheater Tubes (A 213–42).[8]
EA–A 214	Electric-Resistance-Welded Steel Heat-Exchanger and Condenser Tubes (A 214–42).[8]
EA–A 215	Carbon-Steel Castings Suitable for Fusion Welding for Miscellaneous Industrial Uses (A 215–41).[5]
EA–A 216	Carbon-Steel Castings Suitable for Fusion Welding for Service up to 850 F. (A 216–42 T).[6]
EA–A 217	Alloy-Steel Castings Suitable for Fusion Welding for Service from 750 to 1100 F. (A 217–42 T).[6]
EA–A 226	Electric-Resistance-Welded Steel Boiler and Superheater Tubes for High-Pressure Service (A 226–40).[8]
EA–A 227	Hard-Drawn Steel Spring Wire (A 227–41).[6]
EA–A 229	Oil-Tempered Steel Spring Wire (A 229–41).[6]
EA–A 230	Carbon-Steel Valve Spring Quality Wire (A 230–41).[6]
EA–A 235	Carbon-Steel Forgings for General Industrial Use (A 235–42).[10]
EA–A 236a	Carbon-Steel Forgings for Locomotives and Cars (A 236–42).[8]

EA-A 237 Alloy-Steel Forgings for General Industrial Use (A 237–42).[10]
EA-A 238 Alloy-Steel Forgings for Locomotives and Cars (A 238–42).[8]
EA-A 240 Corrosion-Resisting, Chromium and Chromium-Nickel Steel Sheet, Strip, and Plate for Fusion-Welded Unfired Pressure Vessels (A 240–42).[7]
EA-A 241 Hot-Worked High-Carbon Steel Tie Plates (A 241–41).[7]
EA-A 244 Heat-Treated Wrought Steel Wheels (A 244–42).[7]
EA-A 249 Atomic-Hydrogen-Arc-Welded and Electric-Resistance-Welded Alloy-Steel Boiler and Superheater Tubes (A 249–42).[8]
EA-A 250 Electric-Resistance-Welded Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes (A 250–41 T).[8]

Non-Ferrous Metals and Alloys

EA-B 8 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft (B 8–41).[10]
EA-B 12 Copper Bars for Locomotive Staybolts (B 12–42).[10]
EA-B 19 Cartridge Brass Sheet, Strip, and Disk (B 19–42 T).[10]
EA-B 22 Bronze Castings for Turntables and Movable Bridges and for Bearing and Expansion Plates of Fixed Bridges (B 22–40 T).[10]
EA-B 23a White Metal Bearing Alloys (Known Commercially as "Babbitt Metal") (B 23–26).[10]
EA-B 30 Copper-Base Alloys in Ingot Form for Sand Castings (B 30–42 T).[7]
EA-B 32a Soft Solder Metal (B 32–40 T).[10]
EA-B 36 Brass Sheet and Strip (B 36–41 T).[10]
EA-B 60 Castings of the Alloy: Copper 88 per cent, Tin 8 per cent, Zinc 4 per cent (B 60–41).[7]
EA-B 62 Composition Brass or Ounce Metal Castings (B 62–41).[7]
EA-B 85a Aluminum-Base Alloy Die Castings (B 85–42).[11]
EA-B 86a Zinc-Base Alloy Die Castings (B 86–41 T).[9]
EA-B 100 Rolled Copper-Alloy Bearing and Expansion Plates for Bridge and Other Structural Uses (B 100–40).[10]
EA-B 103 Phosphor Bronze Sheet and Strip (B 103–42).[10]
EA-B 111 Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock (B 111–42).[10]
EA-B 121 Leaded Brass Sheet and Strip (B 121–41).[10]
EA-B 122 Copper-Nickel-Zinc and Copper-Nickel Alloy Sheet and Strip (B 122–39 T).[10]
EA-B 124 Copper-Base Alloy Forging Rods, Bars, and Shapes (B 124–42 T).[10]
EA-B 129 Cartridge Brass Cartridge Case Cups (B 129–40 T).[10]
EA-B 130 Gilding Metal Sheet and Strip (B 130–41 T).[10]
EA-B 131 Gilding Metal Bullet Jacket Cups (B 131–40 T).[10]
EA-B 133 Copper Rods, Bars, and Shapes (B 133–42 T).[10]
EA-B 134 Brass Wire (B 134–42 T).[10]
EA-B 135 Miscellaneous Brass Tubes (B 135–42 T).[10]
EA-B 139 Phosphor Bronze Rods, Bars, and Shapes (B 139–42 T).[10]
EA-B 143 Tin-Bronze and Leaded Tin-Bronze Sand Castings (B 143–42 T).[7]
EA-B 144 High-Leaded Tin-Bronze Sand Castings (B 144–42 T).[7]
EA-B 145 Leaded Red Brass and Leaded Semi Red Brass Sand Castings (B 145–42 T).[7]
EA-B 146 Leaded Yellow Brass Sand Castings for General Purposes (B 146–42 T).[7]
EA-B 148a Aluminum-Bronze Sand Castings (B 148–42 T).[10]
EA-B 151 Copper-Nickel-Zinc Alloy Rod and Wire (B 151–42 T).[10]
EA-B 152 Copper Sheet, Strip, and Plate (B 152–41 T).[10]
EA-B 159 Phosphor Bronze Wire (B 159–42 T).[10]
EA-B 169 Aluminum Bronze Sheet and Strip (B 169–41 T).[10]
EA-B 171 Copper-Alloy Condenser Tube Plates (B 171–42 T).[10]

"C" and "D" Groups

EA-C 150 Portland Cement (C 150–42).[1]
EA-D 27a Insulated Wire and Cable: Class AO, 30 per cent Hevea Rubber Compound (D 27–41).[6]
EA-D 69 Friction Tape for General Use for Electrical Purposes (D 69–38).[10]
EA-D 119 Rubber Insulating Tape (D 119–38).[10]
EA-D 224 Asphalt Roofing Surfaced with Powdered Talc or Mica (D 224–41 T).[7]
EA-D 249 Asphalt Roofing Surfaced with Coarse Mineral Granules (D 249–42 T).[7]
EA-D 353 Insulated Wire and Cable: Performance Rubber Compound (D 353–41).[6]
EA-D 375 Test for Asbestos Roving for Electrical Purposes (D 375–42). (Specifications and Methods)[7]
EA-D 455 Milled Toilet Soap (D 455–39).[6]
EA-D 469a Insulated Wire and Cable: Heat-Resisting Rubber Compound (D 469–41).[10]
EA-D 499 White Floating Toilet Soap (D 499–39).[6]
EA-D 524 Test for Carbon Residue of Petroleum Products (Ramsbottom Carbon Residue) (D 524–42).[8]
EA-D 532a Rubber Sheath Compound for Electrical Insulated Cords and Cables (D 532–39 T).[11]
EA-D 533 Built Soap, Powdered (D 533–41).[6]
EA-D 535 Palm Oil Solid Soap (Type A, Pure; Type B, Blended) (D 535–41).[6]
EA-D 536 Palm Oil Chip Soap (Type A, Pure; Type B, Blended) (D 536–42).[6]
EA-D 574 Insulated Wire and Cable: Ozone-Resistant Type Insulation (D 574–40 T).[6]
EA-D 592 Olive Oil Solid Soap (Type A, Pure; Type B, Blended) (D 592–42).[6]
EA-D 593 Salt-Water Soap (D 593–42).[6]
EA-D 607 Mica Pigment (D 607–42).[8]
EA-D 630 Olive Oil Chip Soap (Type A, Pure; Type B, Blended) (D 630–42).[6]

Book on Magnesium Available in United States

THE JANUARY ASTM BULLETIN announced the publication in English of the volume on "The Technology of Magnesium and Its Alloys" as translated from the German. It was announced that this book could be procured from an English concern, but we have received advice from Basic Magnesium, Inc., New York, N. Y., which has the sole license from the Alien Property Custodian to import this book, that Brentano's, 586 Fifth Ave., New York, N. Y., is handling distribution in this country. The book can be obtained from Brentano's at $10 per copy.

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